ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

Vol. LXIV, No. 9. CHICAGO, SATURDAY, FEBRUARY 28, 1914. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
The Administration and the Development of Water Powers 409
Improved Administration of the Patent Office..... 410
Using Electric Novelties for Advertising Purposes..... 411
DEPARTMENTS:
Commercial Practice 418
Electric Sign Data 424
Electrical Construction 425
Dollar Wiring Kinks 429
Public Service Commissions 430
Questions and Answers 432
New Electrical and Mechanical Appliances..... 443
Latest Appproved Fittings 448
Current Electrical News 449
Record of Electrical Patents 455
LEADING ARTICLES:
Electricity in Car Shops 413
Some Notes on the Large Power Rate.—By E. D. Dreyfus. 419
Humor and Pathos of Electrical Contracting.—By J. A. Fowler 425
The Hydroelectric Power Situation in the Northwest.—By J. J. Wettrick 436
Industrial Research in America 439
LETTER TO THE EDITOR:
Catalog Numbers and Designations.—By E. M. Raetz.... 428
MISCELLANEOUS:
Commonwealth Edison Company Elects Staff of Vice-President to Control Different Departments..... 412
Westinghouse Electric Veterans Organize..... 412
Successful Iron Campaign at Fort Worth, Tex..... 418
New York Edison Company's Exhibit..... 423
J. A. Fowler Re-Elected Secretary of Tennessee Association 426
Among the Contractors 426
A Unique Show-Window Device 427
Contact Maker for Spark Plug..... 428
American Telephone & Telegraph Arranges for Disposition of $30,000,000 of Western Union Stock..... 431
Convention of Electrical Supply Jobbers' Association.... 431
Panama Canal Switchboards Described for Chicago Electrical Engineers 431
The Public and the Telephone Service of a Big City.... 434
Prizes for Fiftieth Anniversary Celebration of Columbia School of Mines 434
N. E. L. A. Exhibit Committee Formulates Convention Exhibition Plans 435
Controversy Over Power Sites in National Forests..... 435
Pennsylvania Electrification 441
Annual Report of the Commissioner of Patents 442

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THE ADMINISTRATION AND THE DEVELOPMENT OF WATER POWERS.

During the last 10 years the question of the development of the water powers of the United States has been given a great deal of consideration by the administrations headed by Mr. Roosevelt, Mr. Taft and Mr. Wilson. On February 17 practically an entire session of President Wilson and his Cabinet was devoted to a discussion of this problem. While the views of the President and Secretary of War Lindlay M. Garrison have been anticipated with some degree of certainty, it is only now apparent what it is hoped by the Administration will be accomplished in the bills which are to be drafted to meet this situation.

On February 19, Secretary of War Garrison addressed to the Hon. W. C. Adamson, chairman of the House Committee, a letter outlining the suggested form of a bill. Secretary Garrison says "The practical situation which has to be dealt with may fairly be summarized as follows: On the one side are those who insist that law and policy indicate the necessity of leaving the entire matter in the hands of the Federal Government, which shall not only indicate the places and authorize the character of work where development of this kind may be undertaken, but shall profit by the avails therefrom; on the other hand there are those who would limit the extent of the National Government's action to the making of such conditions as concern navigation in the streams and would leave all else thereafter to the respective States."

It is well known that between the contending opinions that a deadlock had been reached and that unless some definite opinion was expressed, conditions looked fair for a permanent standstill. It was necessary then to consider not only the law, but also the equities and interests of all concerned. Secretary Garrison continues: "Legally speaking, I do not think there can be any dispute that, with respect to the question of power, the position of the Federal Government is paramount. Nothing can be done without its consent, and only that can be done to which it consents. There is no justification for a policy of do-nothing. Therefore, the question is: What is the wise policy to adopt that something may be done? The interests to be considered and the equities with respect thereto, I view as follows: First, of course, there are the communities which will benefit by the utilization of the water power developed by the placing of dams in navigable streams.

Next is the immediate sovereign over them which would direct this matter and have power with respect thereto, were it not for the paramount power above alluded to, which resides in the Federal Government. Finally, there is the Federal Government with absolute power by reason of its ability legally to prevent the doing of anything without its consent. Therefore, the proper solution seems to me to be to see to it that this great public utility, wherever availed of, should be availed of in a way that will benefit the greatest number under the most favorable terms possible; and in doing so, to recognize the justice (not as a matter of law) of the State entity or sovereignty receiving a revenue from the operation of this public utility within its confines and regulating it for the benefit of its people."

The draft of the bill, therefore, which it will be suggested for introduction into Congress and will constitute a new Public Dam Act, will provide that those who wish to dam a navigable stream and incidentally create water power must, as at present, obtain the right so to do from this State. They must then obtain authority from the Congress. The company seeking this right must be a public utility company and subject to laws regulating public utilities. The State in which a company is incorporated or in which it operates must have provided a commission or body authorized and empowered to properly regulate public utilities of this character. Where the provisions have been complied with the Secretary of War may issue the permit and the franchise or right may be for any period up to 50 years. Provisions will be included retaining power in the hands of the Secretary of War, and in some instances in Congress to prevent any violation of the things which the Act requires the company to do.

In outlining the relation of the State and Federal authorities, so far as the local situation is concerned, Secretary Garrison says: "The local situation will, of course, be dealt with under the laws above alluded to, which the State must have provided before its corporations can receive favorable consideration at the hands of Federal authority. The State, as above mentioned, may make proper provisions for the taxation or receipt of revenue. It has been suggested that the State might properly provide, if it so chose, a scheme by which, in consideration of no imposts, or of slight imposts, the dam and accessory work should, at the end of a fixed period, become the property of the State. In other words, the State might say: 'Instead of taxing you or getting a revenue out of you during the life of this franchise, we will abstain from so doing and take our payment, as it were, in a lump sum, namely, the improvement, which shall thereupon become ours.' By so doing, of course, the State would substitute itself for the previous grantee, and be identically situated with respect to the Federal Government." This latter is thrown out as a tentative suggestion, it is believed, and it is doubtful if it will be written into the Act.

The Act will make the dams and works previously authorized under statutes retaining the power to amend, repeal, etc., subject to its provisions. As to navigation dams erected by the Federal Government at which hydroelectric power may be developed incidentally, the Act will probably place the disposition of such power in the hands of the Secretary of War, who may permit the development and use thereof by companies in states which have complied with the requirements outlined heretofore as public utilities.

The ultimate development of this Act will be in the hands of Congress after thorough investigation of the opinions of every interest concerned. Secretary Garrison has been over the subject with the President, and is authorized to say that Mr. Wilson approves of the general principles underlying the bill and of the methods proposed to bring it into effect. The draft of the bill accompanied the letter of Secretary Garrison, but this has not been given out. It is announced in Washington that hearings are to be held on all the bills before the House Committee, and that there is to be legislation on water power at this session of Congress.

IMPROVED ADMINISTRATION OF THE PATENT OFFICE.

Much interest has been taken in recent years in various efforts to improve the American patent system, both by amendment of the patent laws and by reform of the practices of the United States Patent Office. Respecting the former there has been much controversy, largely because, like other lawyers, patent attorneys are unable to agree on improved practices respecting their profession. As to reform of the Patent Office there is greater agreement and it is on some features connected therewith that these comments are made.

The general concensus of opinion is that the administrative difficulties of the Patent Office are chiefly due to the parsimonious treatment of this bureau by Congress. The crowded condition of the quarters occupied by the Office has continually hampered its work and, since it is housed in a non-fireproof building, many of the extremely valuable records are constantly in danger of being lost or destroyed. Thus there are scattered in various portions of the establishment some 50,000,000 printed copies of patents, which in themselves represent a considerable investment and at the same time clutter up corridors and all available storage space. It has been repeatedly urged that Congress grant an appropriation for the construction of a new building designed particularly for the work of the Patent Office and built in a style appropriate to the importance of this government bureau. Another serious difficulty has been the inadequacy of the working force, as a result of which many needless delays occur in prosecuting an application for a patent through the Office. These conditions are the more anomalous because the Patent Office is one of the few self-supporting branches of government activity; moreover, it has each year a neat surplus, which in 1913 amounted to over $137,000; in

fact, the total net surplus to the credit of the Patent Office and which is lying idle in the Treasury of the United States amounts to over $7,300,000. This money has been contributed by inventors and should naturally be used for improving conditions in the Patent Office and facilitating its work.

Although he has held his present position only about half a year, Commissioner of Patents Thomas Ewing has embodied many valuable suggestions in his first annual report to Congress covering the work of the Patent Office for the past year; an abstract of this report is given on another page of this issue. Mr. Ewing has pointed out many ways in which the work of the Office can be improved. Among his recommendations are the need for increased room, reorganization and increase in the examining corps, enlargement and reorganization of the library, a revised publication of the *Official Gazette*, regulations to prevent undue delay in the prosecution of applications, increased facilities for reclassification of patents, and also a number of changes in the patent law to expedite the work of the Office and make it more accurate and equitable.

Respecting these recommendations it is desired here to refer particularly to the proposed change in the manner of publishing the *Official Gazette*. This publication appears every week and gives the list of all patents issued during that week, which number on the average about 700 weekly. Since the title of the patent is in but few cases really descriptive of the patented feature, it has been the custom to publish in the *Gazette* the claims made by the inventor together with one of the drawings accompanying the specifications. The *Gazette* has been continually becoming more and more cumbersome and so a few years ago the practice of printing all of the claims was dropped and only the first five, in case more than five claims were made to any patent, were published. Nevertheless, each issue of the *Gazette* still averages something over 300 pages. Moreover, on reading the claims published a person cannot get even an approximate idea in many cases of what the patent deals with. Some of these claims contain several hundred words and it is extremely difficult to determine what the patented feature is in such a mass of verbiage.

The suggestion has therefore been made that, instead of publishing selected claims, there should be published a brief digest of each patent. Such a digest would be of extreme value to every one interested in keeping in touch with patent developments in any particular line. It would also be of value to the examiners in the Patent Office in simplifying the work of searching prior patents in any class. To put this desirable reform into effect it is necessary merely that a corps of digesters, specially trained in intelligently digesting patents, be provided. Commissioner Ewing points out that the expense of such a corps would probably be almost entirely saved by the decrease in the cost of printing the *Gazette*, since the bulk of that publication could doubtless be reduced by 40 or 50 per cent. It is to be hoped therefore that among the various reforms suggested by Mr. Ewing this one be put into effect at the earliest possible moment.

USING ELECTRIC NOVELTIES FOR ADVERTISING PURPOSES.

It is becoming rather common nowadays to see show-window displays which are enlivened by electric novelties of one kind or another. Window displays are especially attractive when they involve motion or a change of some kind, and the electric current provides an agent for this purpose which can be applied in almost numberless ways.

The most surprising feature about such developments is the fact that these window displays are featured in shops carrying on all kinds of business except that devoted to the sale of electrical appliances. It would seem as if both the dealer in electric specialties and the central station are missing a means for advertising which should be peculiarly their own, and it behooves more of them to make use of electrical means for making their show windows attractive.

In this issue is described a show-window device which was devised by an electrician purely to attract the attention of passers-by, since it bears no relation whatever to the business of the advertiser. It consists of an incandescent lamp which is lighted without connection to any visible electrical conductors. Naturally it puzzles the ordinary observer and suggests the wireless transmission of energy which has lately been heralded in the newspapers.

Aside from the mere use of the electric motor to provide displays involving motion of some kind or the carrying out of a manufacturing or other demonstration process, there are many puzzling exhibits which can be arranged by the electrical expert. Thus a hidden magnet may be made to move objects around over a table top or a plate of glass in a very mysterious manner. An incandescent lamp may be made to light while immersed in a vessel of water by being mounted upon a coil of wire which forms a closed secondary circuit for a transformer whose primary winding and core are out of sight. The same primary winding may serve to heat up an aluminum skillet or other vessel sufficiently to make water boil. The skillet in this case constitutes the secondary.

Many other attractive and puzzling devices may be arranged by the electrician who is familiar with the properties of alternating currents and it is not necessary to enumerate the long list of them here. Such features being dependent upon the electric current are especially suitable for the window of the electrical contractor and dealer; he need not, however, confine the application of them to his own business, but should be able to turn a dollar here and there by rigging up similar displays for fellow merchants. There is a large field here for the electrician with initiative and energy.

Commonwealth Edison Company Elects Staff of Vice-Presidents to Control Different Departments.

The annual meeting of the stockholders of the Commonwealth Edison Company, Chicago, Ill., was held on February 24, and the old directors were re-elected. A new policy was adopted which consists in having a staff of working vice-presidents, and the old directors were re-elected as follows: Henry A. Blair, Benjamin Carpenter, Samuel Insull, Robert T. Lincoln, John J. Mitchell, James A. Patten, John G. Shedd, Byron L. Smith, A. A. Sprague.

Immediately following the stockholders' meeting the board of directors met and elected the following executive committee: Samuel Insull, chairman; John J. Mitchell, Byron L. Smith, A. A. Sprague and James A. Patten.

The by-laws were amended to effect the change in organization and make possible the new staff of vice-presidents. The following officers were elected: Samuel Insull, president; Louis A. Ferguson, vice-president, in charge of the contract, operating and construction departments; John F. Gilchrist, vice-president, in charge of the purchasing, stores, transportation and statistical departments; William A. Fox, vice-president, in charge of finances and securities and claims, with supervision over the secretary and the treasurer and their departments; John H. Gulick, vice-president, in charge of accounting, with supervision over the auditors and the auditing department; Edward J. Doyle, secretary and treasurer; George E. Burns, assistant treasurer; Robert L. Elliott, assistant secretary; William S. Kline, assistant secretary; Henry E. Addenbrooke, auditor; R. H. Williams, assistant auditor; Harry A. Weigle, assistant auditor.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held in the Gold Room of the Commercial Club Salt Lake City, Utah, on February 19, A. A. Knowlton, professor of physics at the University of Utah, spoke on "The Electrical Method of Smoke Prevention." He illustrated with a small experimental model of the Cottrell system of smoke deposition which is now being applied to two of the large smelters in the Salt Lake valley, and which offers to afford a fairly satisfactory solution of the problem of smoke prevention as applied to large stacks, as indicated by the results of the experiments so far.

Dr. Knowlton stated, however, that according to his observations much of the smoke in Salt Lake City in the residential portion is caused by the smoke from the small stacks of residences and apartment houses in that section. He offered a resolution, which was adopted, providing that the Electric Club recommend to the Commission of Salt Lake City that it employ a corps of experts, to be headed by the best authority on the subject to be found in the country, to study the smoke problem as it affects the city.

Ex-Governor Heber M. Wells, who is now commissioner of parks and public property, was present and expressed himself as favoring this move. Mr. Wells was largely responsible for the recent smoke-prevention ordinance passed by the City Commission. He stated that the Commission had studied the ordinances with reference to this subject in all of the principal cities of the country, and after careful consideration, had adopted one patterned after the ordinance now in effect in Chicago, which seems to meet the conditions existing here.

A. I. E. E. Lynn Section Meeting.

The lecture by Elihu Thomson on "Color Photography," given in Burdett Hall, Lynn, Mass., on February 18, was of exceptional interest, and largely attended by members of the Lynn Section, American Institute of Electrical Engineers. In addition to the description of a series of beautiful colored lantern slides which were shown, the lecturer, by means of diagrams and chemical experiments, elucidated his theme thoroughly. The photographs were taken personally by the speaker in various parts of the world, not the least interesting being views of Professor Thomson's flower garden at Swampscott, Mass.

The next meeting in the present course will be given March 4, when W. C. Fish, manager of the Lynn works of the General Electric Company, will speak.

Engineers Dinner in Boston.

A co-operative dinner to be participated in jointly by the local sections of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and the Boston Society of Civil Engineers will be held at the Boston City Club, Wednesday evening, March 4. The speakers will be Guy E. Tripp, who will speak on "The National Government and Business;" Dr. A. E. Kennelly, who has chosen as his subject, "Results for the Electrical Engineering Fraternity Accomplished by the I. C. E.;" and Dr. M. W. Franklin, who will speak on, "Ozone Applied to Ventilation."

This is the fifth annual event of this character held by Boston engineers and as in previous years all interested parties are invited to attend. Reservations should be sent to Harold G. Payne, 12 Pearl Street, Boston.

Westinghouse Electric Veterans Organize.

On the evening of February 21 the employees of the Westinghouse Electric & Manufacturing Company who have been in its employ for a period of 20 years or more held a meeting at the Fort Pitt Hotel, Pittsburgh, Pa., and organized the Veteran Employees' Association of the Westinghouse Electric & Manufacturing Company. A regular business meeting was held to formulate the organization, by-laws were adopted, and officers were elected for the ensuing year.

A striking fact was the youthful appearance of these so-called veterans, as the majority of the crowd appeared to be men in the prime of life. About 325 employees of the company are eligible to membership, and approximately 315 of these were present at the meeting. Nor were all these of the male sex, as one woman was present also, she being a foreman of the detail division in the shop.

Following the dinner, an interesting program was carried out consisting of speeches and vaudeville. The toastmaster was L. A. Osborne, vice-president of the company. The speakers were E. M. Herr, president; Charles A. Terry, vice-president, and James J. Barrett, representing the shop. Mr. Herr,in the course of his remarks, promised the support of the company to the organization, and also stated that the officials of the company were working on a pension plan for the employees, details of which will be announced later. Mr. Terry gave a number of interesting reminiscences of the developments which have occurred during his experience of over a quarter of a century with the company.

Guy E. Tripp, chairman of the board of directors, was present and was elected an honorary member of the Association, as was also Mr. Herr, neither of these gentlemen having been connected with the company the required number, 20 years.

A standing toast was drunk to George Westinghouse, who was unable to be present on account of illness.

Society for Electrical Development to Begin Active Work.

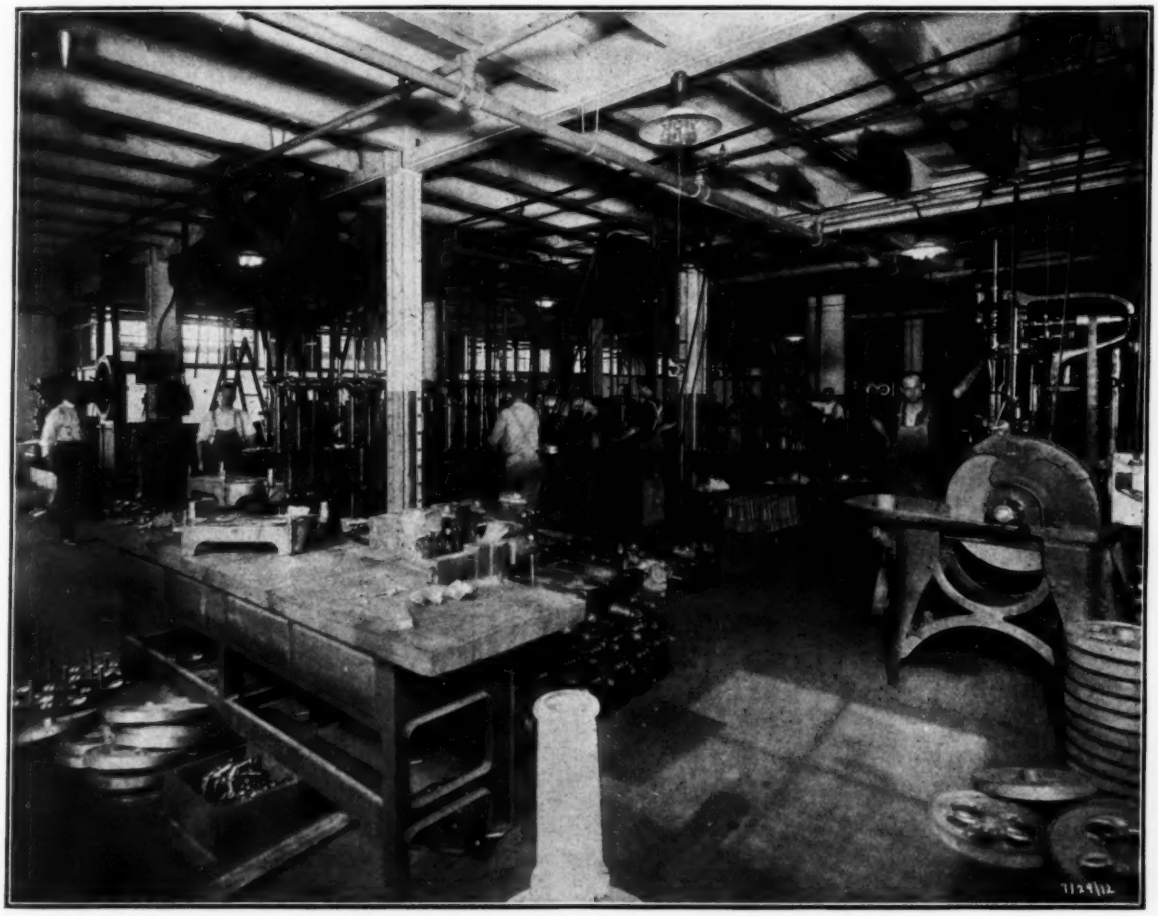
Announcement is made by J. M. Wakeman, general manager of the Society for Electrical Development, Incorporated, that the organization is now officially active. Its minimum fund of $200,000 has been subscribed. The Society will begin its active work of educating the public to "Do It Electrically" about March 1. While the industry is assured of the active work of the Society, it is especially to be desired that those who are not now members will immediately join.

Electricity in Car Shops.

A combination of the problems encountered in electrifying machine shops, woodworking plants, blacksmith shops, etc., must be met in applying motor drive to railway car shops as the modern institution of this character is usually a combination of these industries. The same advantages that apply to these individual branches, however, apply with equal force to car shops.

In recent years railroads have joined with manufacturing establishments in utilizing to the greatest possible extent electricity for all conceivable purposes. The tendency, also, is to purchase power because of the many advantages of central-station service over isolated-plant supply. It is significant that even in the coal fields, where cheap fuel is available, railroads have found it advisable to leave the generation of power to companies established for this purpose.

In soliciting the adoption of central-station service by railroad car shops the power engineer should be well provided with facts and figures regarding the economy and advantages of motor drive in machine shops, woodworking plants, blacksmith shops, etc., as the modern car shop is a combination of these. In the following paragraphs is presented details of the electrification of the new shops of the Hocking Valley Railroad which will convey, in a measure, some idea of the problems that have been encountered.



General View of Machine Shop Driven by Electric Motors.

The greatest problem the mechanical department of a railroad has to solve lies in the repairing and renewing of freight cars in such a manner as to keep the number of cars out of service at one time as small as possible and to prevent, as far as practicable, any delays to trains, due to defects which may develop while the cars are in transit. To accomplish this it is necessary to have a modern plant, managed by competent officials, with an efficient force of workmen, so located that cars may be received and delivered without undue haulage and repairs made with the greatest despatch.

For a number of years the Hocking Valley Railway Company did practically all its car repair work in the South Columbus shops of the company; but the facilities there were inadequate for the constantly increasing demand for work of this character and, after a careful consideration of the various details involving the location of a plant to effect economical operations and accomplish the greatest efficiency, a modern plant in every respect was built at Logan, Ohio. This town represents the most advantageous distributing point for the equipment, inasmuch as it is the central station for the four divisions of the Hocking Valley Railway and is also the distributing point for coal cars, which represent 80 per cent of the company's business. The heavy coal tonnage necessarily made repairs for the coal-carrying equipment a large item, but with the shops at Logan the

company effects a considerable saving in the transportation of cars; and further, the fact that the cars can be taken directly from the shop and distributed to the various coal properties was another factor in deciding on this location. After determining upon the site, the officials of the Hocking Valley Railway Company made a careful inspection of the most modern practice in the United States, with a view to building a plant not to be surpassed in design and equipment.

The works consist of eight buildings of brick and steel construction, as follows: Car repair and assembly shop, saw shop, office and store room; blacksmith shop; wheel, axle and air-brake shop; lumber storage building; and oil house.

These are concentrated along a traveling crane runway, which serves all of the main buildings beginning with the saw shop building or mill, main repair or erecting shop, blacksmith shop, store room and material platforms. This crane runway is 600 feet long, and the traveling crane which runs upon it is capable of lifting a load of five tons.

At the southeast end of the crane runway is located the saw shop or mill. This structure, 200 feet long, 70 feet wide, is built of paving brick on concrete foundations, and as much of the walls is given to windows as is consistent with strength. The roof, supported by steel trusses, is equipped with 18 large sky-lights glazed with wire-inserted glass. A monitor runs the length of the roof, also to give light and ventilation. Inasmuch as by far the largest percentage of repair work done is on the wooden coal cars, naturally the greatest amount of power utilized is in the saw shop.

In this building all the lumber used in the reconstruction of the cars is worked into the necessary shape and sizes. To accomplish this the shop is equipped with a swing cut-off saw, tenoner, two boring machines, gainer, cross-cut saw, timber planer and matcher, rip and band saws, together with the necessary grinding machines.

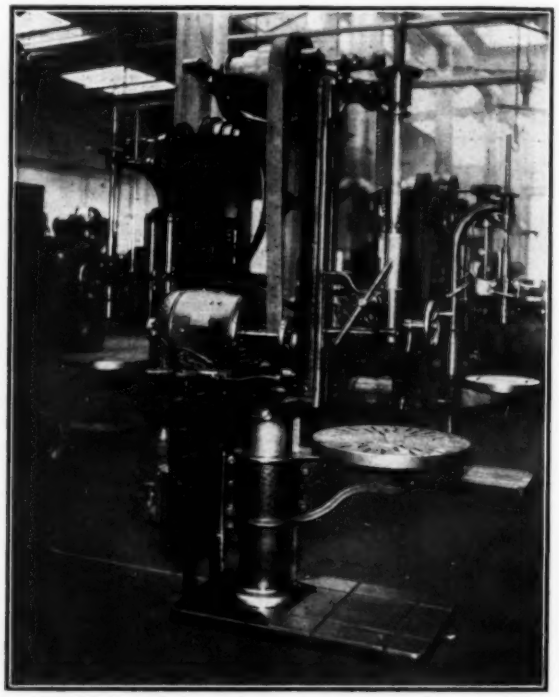
These tools are all connected to 60-cycle, three-phase, 1,130-revolutions-per-minute induction motors, fifteen motors in all being employed in this capacity, as follows:

One cut-off saw belted to a 15-horsepower motor.
One timber sizer direct-connected to 50-horsepower motor.
One swing saw belted to a 5-horsepower motor.
One tenoning machine belted to a 15-horsepower motor.
One mortiser belted to 15-horsepower motor.
One rip saw, one gainer, one wood worker and one tenoner grouped on a 15-horsepower motor.
One self-feed rip saw belted to 15-horsepower motor.
One gaining machine belted to 15-horsepower motor.
Two three-spindle boring machines, one single band saw, one automatic knife grinder belted in group to 20-horsepower motor.
One planer and matcher direct-connected to a 50-horsepower motor.
One gainer belted to 15-horsepower motor.
One gainer belted to 10-horsepower motor.
One three-spindle boring machine belted to 10-horsepower motor.

The arrangement of this machinery leaves practically nothing to be desired and was greatly facilitated by application of the electric drive. The timber is received in the rough at the east end of the shop and delivered in a finished condition at the west end ready to go to the dry lumber shed, which is located some distance west of this shop, or to the main car-repair shop, which is located just north.

An extensive dust-conveying system has been installed throughout the shop. To each machine is attached a receiver, into which the shavings, dust, etc., are drawn by a fan belted to a 40-horsepower motor located on the roof trusses. All the dust is then transmitted in the usual way back to the boiler room and fed into the furnaces as fuel. At the end of the saw shop is located a relay fan to help in the transmission, being driven by a 50-horsepower motor. The building is well lighted with arc lamps and each machine has one or more incandescent lamps.

Motor Driving Gear Cutter.



Individual Motor Drive in Machine Shop.

Round House.

The round house located along the right of way has a small auxiliary machine shop, which is driven by a 15-horsepower belted-type motor. The round house was for a time equipped with its own boiler and engine plant as the water storage tanks are also located at this point; however, this plant has since been discontinued and the pump is now driven by a 15-horsepower direct-connected motor.

Wheel, Axle and Air-Brake Shop.

The designation, wheel, axle and air-

Car Shop Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Railway car-repair shop repairing principally freight cars. The main machine and woodworking shops operate independent of each other and also are provided with separate meters.

Machine Shop.

There is a total of 125 men employed, some of whom work nine hours during the day and the remainder at night.

Total connected horsepower, 98. Total number of motors installed, 8. Average kilowatt-hours per month, 10,012.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours	Month	Kilowatt-Hours	Month	Kilowatt-Hours
January	9,570	May	8,820	September	8,100
February	11,000	June	7,280	October	10,510
March	8,580	July	7,880	November	10,980
April	16,640	August	9,280	December	11,510

Load-factor, 19 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	7.5	1,700	Belted to a six-foot shaft (two hangers) and two countershafts (four hangers) driving one Beach Manufacturing Company jig saw; one Bentel & Margedant 24-inch pattern lathe.
1	15	1,120	Belted to 120 feet of shafting (22 hangers) and 12 two-hanger countershafts driving one Bradford 14-inch engine lathe; one Jones & Lamson three-inch turret lathe; one Columbia 30-inch boring mill; one Lodge & Shipley 18-inch lathe; one Binssee horizontal boring mill; one Lodge & Shipley 20-inch combination turret and engine lathe; one Laponite No. 2 broaching machine; one Jones & Lamson 2.25-inch turret lathe; one Prentice Tool & Supply Company 16-inch lathe; one Dresses 18-inch turret lathe; one six-inch forming lathe; one Jones & Lamson 2.25-inch chucking lathe; one Baker Brothers 24-inch double-machine drill; one polishing lathe (two 12-inch by three-inch wheels); one 24-inch exhaust fan; one tire bender; three eight-feet by 12-inch tumbling barrels; one automatic punch press (32-inch flywheel, six-inch by 2.5-inch rim); one Woodward & Rogers tapping machine; one G. W. Heartley punch press (19-inch flywheel, four-inch by two-inch rim); one C. S. Shuster wire straightener (18-inch flywheel, 4.25-inch by 2-inch rim); one double emery wheel (9-inch by .5-inch wheels); one No. 1-C punch press (12-inch flywheel, 2-inch by 2-inch rim); two two-spindle special horizontal drills; one spoke leader (30-inch flywheel, 4.25 by 2-inch rim); one thread rolling machine; one Fox rim-drilling machine; one Rockford 18-inch drill; one five-ton screw press; one Fairbank 12-inch sensitive drill; one spoke-shearing machine (16-inch flywheel, 4-inch by 1.5-inch rim).
1	5	1,700	Belted to a 14-inch shaft (four hangers) and three two-hanger countershafts driving one 16-inch cut-off saw; one Witherby, Rugg & Richardson 12-inch jointer; one Hermance 12-inch combination rip saw and horizontal drill; and one 20-inch pony planer.
1	7.5	1,700	Belted to a 30-foot shaft and a two-hanger countershaft driving one J. F. Coffman miller; one eight-inch sensitive drill; one E. W. Bliss No. 2.5 punch press (24-inch flywheel, five-inch by three-inch rim); one Standard Machinery Company No. 2-C punch press (18-inch flywheel, 3.5 by 2.5-inch rim); one 18-inch drill press; one Mossberg No. 2-C punch press (18-inch flywheel, 3.5-inch by 2.5-inch rim); one Rockford 18-inch drill.
1	15	1,120	Belted to a nine-kilowatt 12-volt 750-revolutions-per-minute generator.
1	40	850	Belted to 180 feet of line shafting and five two-hanger countershafts driving special tire rolling department (secret process); one West tire setter; one 150-light 110-volt direct-current generator; one tire expander; one 2,000-pound freight elevator; four Rockford 18-inch drills; two Cincinnati two-inch plain millers; two 12-inch sensitive drills; one Bradford 16-inch lathe; one Michigan Machinery Company size 21 punch press (24-inch flywheel, four-inch by two-inch rim).
1	0.5		Belted to a 16-inch exhaust fan.
1	7.5	1,700	Belted to line shafting driving one Porter 24-inch lathe; one Bradford 22-inch lathe; one Steptoe 16-inch shaper; one 10-inch tool grinder; one V and O No. 3 punch press; two special rolling machines; one E. W. Bliss No. 2½ press.

There are three Thomson welding machines installed taking power from the central-station circuit.

Car Shop Data—Sheet No. 2.

WOODWORKING SHOP.

Total connected horsepower, 125. Total number of motors installed, 8. Average kilowatt-hours per month, 11,490.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
May	16,000	September	9,000	January	9,000
June	17,300	October	6,900	February	10,500
July	14,600	November	8,600	March	11,500
August	14,200	December	8,300	April	12,000

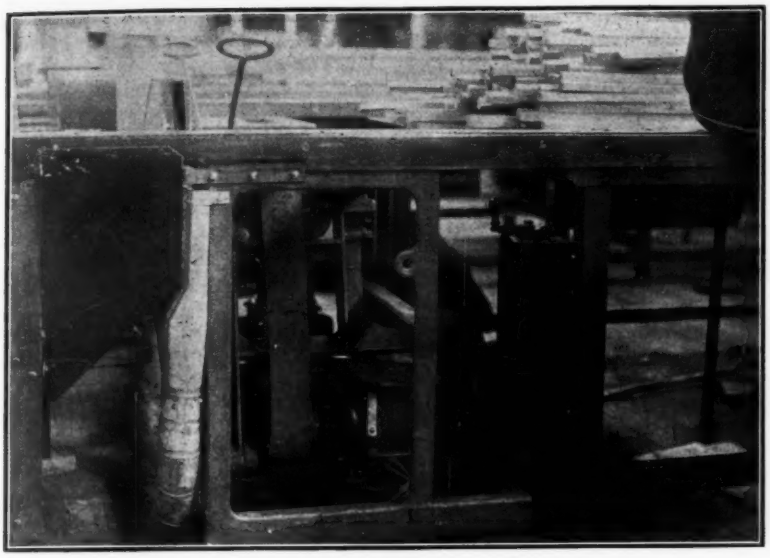
Load-factor, 16 per cent.

Operating-time load-factor, 35.3 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power	Speed R. P. M.	Application.
1	20	710	Belted to an American steel-plate double 40-E exhauster.
1	7	700	Belted to a 20-foot shaft, four hangers and three two-hanger countershafts driving one Berlin No. 225 12-inch rip saw, 4,000 revolutions per minute; one Falls Machine Company tool grinder 10-inch by 0.25-inch stone; one Goedell & Pratt double emery wheel; and two William Menge automatic needlers.
1	15	710	Belted to an American steel-plate double 30-E exhauster.
1	7.5	710	Belted to a 90-foot shaft, 10 hangers and four two-hanger countershafts driving one William Menge 10-inch rip saw; one H. B. Smith three-head four-inch molder; two Pyribil 10-inch rip saws; and one William Menge four-inch cut-off saw.
1	7.5	710	Belted to a B. F. Sturtevant 40-inch exhaust fan.
1	25	720	Belted to a 125-foot line shaft, 20 hangers, and nine five-foot two-hanger countershafts driving four Hansen & Van Winkle No. 3 double emery wheels; one small speed lathe; one W. F. & J. Barnes 20-inch drill; one three-spindle drill; one D. F. Sturtevant 30-inch exhaust fan; three G. H. Walker four-inch cut-off saws; five William Menge four-inch cut-off saws; and two Wysong & Miles belt sanders, belts two inches to six inches wide, speed 2,100 feet per minute.
1	3	1,400	Belted to a 40-foot shaft, nine hangers, and seven two-hanger countershafts driving two A. H. Nilson horizontal boring mills; three William Menge speed lathes; one William Menge three-inch cut-off saw; and one William Menge sticker.
1	40	720	Belted to a 170-foot shaft, 34 hangers, and three two-hanger countershafts driving two G. A. Walker four-inch cut-off saws; one shank roller; four wooden tumbling barrels, 12 inches by 36 inches; one Baldwin metal drill; two Nilson boring machines; one Nilson "sticker" boring machine; one William Menge siding-off machine; one William Menge flange-boring machine, four spindles; one Menge flange-boring machine, two spindles; one A. H. Nilson damper block; one Menge boring machine, three spindles; one Menge damper-boring machine, four spindles; one Frazer butt machine, five spindles; two Menge fly-boring machines, three spindles; one butt frazing-out machine; one fly siding-off machine; one A. H. Nilson butt-boring machine, five spindles; one A. H. Nilson button maker, three spindles; one A. H. Nilson spring rail-boring machine; one Menge Dowell borer, two spindles; three Menge flange borers, four spindles; two Menge tongue borers, four spindles; one Menge fly-flange borer, two spindles; two A. H. Nilson regulating rail borers, two spindles; two A. H. Nilson rail borers, four spindles; one American Blower Company double 35-inch steel plate exhaust fan, 1,550 revolutions per minute; one A. H. Nilson shank machine; one Pyribil 10-inch single-head molder; one 10-inch rip-saw; one eight-inch rip-saw; one 10-inch single-head molder; one four-head eight-inch molder; one 12-inch jointer. One American 14-inch swing cut-off saw. One Berlin 10-inch rip saw. One American 22-inch jointer. One 40-inch by two-inch band saw. One double emery wheel 10-inch by one-inch. One 1,200-watt plating generator.



Motor Driving Slasher in Car Shop.

brake shop, signifies the nature of the repairs carried on in this building. It is 90 feet long and 50 feet wide and is characteristic of the other buildings in respect to light, ventilation and heating. Four motors, aggregating 92.5 horsepower, drive the various machines installed in this shop.

The equipment consists of one hydraulic wheel press driven by a 7.5-horsepower geared motor, which is mounted on the top of the press.

One axle lathe, one boring mill and one small pipe-cutting machine are driven in group from a 40-horsepower 900-revolutions-per-minute motor.

One vertical drill press and one double-end emery grinder are driven in group from a 5-horsepower 1,130-revolutions-per-minute motor.

A 40-horsepower motor is mounted on the wall for driving the larger machines in the wheel shop.

Car-Assembling and Repair Shop.

The car-assembling and repair shop, which is 500 feet long and 160 feet wide, is so located that the material from all the other buildings naturally gravitates to this section of the works. It is of steel construction with a tar and gravel roof. The sides of the building are sheathed with corrugated iron and are so designed that every other panel is a roller door or a window. In the summer the windows may be opened and the doors rolled up so that practically the sides of the building are opened. The natural lighting of the building is increased by wire-inserted glass skylights and a monitor running the full length of the building, the windows of which for ventilating purposes are regulated by a system of levers.

The building contains three ten-ton cranes to assist in the erection work. In front of the building and under a canopy is located a ten-ton crane which is free to travel in front of the blacksmith shop and the saw shop and convey the heavier parts to the car-assembling shop. It is also arranged to take care of the wheels and axles after they come from the wheel shop. The car shop has a capacity of seventy cars, distributed on six tracks running longitudinally. There are also four larry tracks, on which push cars may be operated to increase the facilities for handling material.

The heating system of this building includes two blowers, each driven by belting from a 50-horsepower motor.

The Blacksmith Shop.

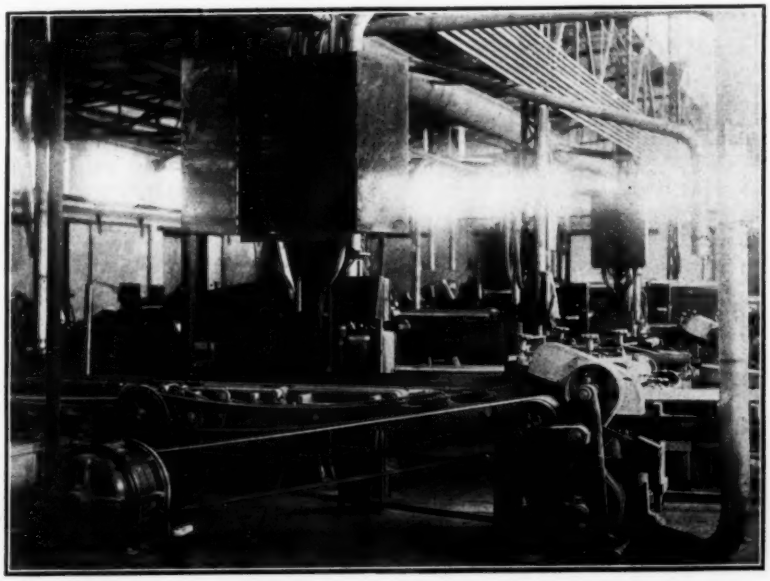
The blacksmith shop, 160 feet long and 70 feet wide, is similar in design and construction to the saw shop. All machines in this building are arranged in groups, as much as possible, and driven from line shaft. There are eight heavy forges installed, the air for which is supplied by a fan belted to a 40-horsepower motor. One combination punch and shear and a bulldozer are driven in a group from a 30-horsepower 900-revolutions-per-minute motor. One double emery wheel, one grinder, one two-drill press and other light tools are driven in a group from a 15-horsepower motor, running at 1,130 revolutions per minute.

Three triple bolt threaders, one punch, one emery grinder, one "I"-bending machine, one 7.5-inch bolt header and one guillotine shears are driven in group by a 30-horsepower motor. All these motors are mounted on the walls of this shop, about six feet above the floor line, so they consume practically no space and are not high enough to be injured by the smoke and dirt, which naturally exist in such a shop.

The blower heating system for the shop is driven from a 15-horsepower motor.

Choice of Motors.

Induction motors are, in all respects, the best type of machine for general power distribution on alternating-current circuits, and they have special advantages for operation in plants of this kind, having no moving electrical contacts and consequently causing no fire risk. They also start under load, run at approximately constant speed regardless of load, and if the load is suddenly thrown off no racing can occur. They are extremely simple in construction, having no commutator or brushes, and this, as above intimated, insures absolute freedom from sparking, flash-



Motor Driving Gang Rip Saw in Car Shop.

ing or burning. The voltage in the rotator part is so low that insulation breakdowns do not occur. Furthermore, an induction motor, when started, does not require synchronizing; and, on account of its simple construction and absence of all auxiliary devices, except starters, the cost of maintenance and attendance is considerably less than for any other type of electric motor.

There are installed in this plant 23 constant-speed Allis-Chalmers induction motors with a combined capacity of 603 horsepower, not including the three ten-ton cranes, which are each equipped with 35 rated horsepower. The Webster vacuum heating system is installed in the entire plant.

The Logan shops of the Hocking Valley Railway represent an investment of $350,000 approximately, but it will readily be realized that the company has improved its service to a far greater degree than that shown by these figures. The shops will employ 450 men and will turn out 5,000 heavy repair cars each year.

Commercial Practice
Management, Rates, New Business

Successful Iron Campaign at Fort Worth, Tex.

During a recent campaign in which the Fort Worth (Tex.) Power & Light Company sold General Electric irons for $3.50, on a time-payment plan of 50 cents down and $1.00 per month, practically 5,000 electric irons were sold. Of this number about 2,500 irons were sold by the company and the remainder were disposed of by the local electrical contractors and dealers who entered enthusiastically into the campaign. A cash price of $3.00 was made by the later.

Toward the end of the time alloted for the campaign sales began to decrease so a special cash sale was announced for one month. During this sale irons were sold for $3.50. However, $1.25 was allowed on every old iron brought in exchange for a new one, making the net cash price $2.25. There were 375 irons sold on this basis during the month of the sale.

The fact that the Feeders and Breeders Stock Show was to be held in Fort Worth during the time of the sale, at which the lighting company was to maintain an exhibit, suggested an advertising scheme in which the old irons brought in exchange for new ones could be made a feature. The display shown in Fig. 1 is a result, and shows a few of the replaced irons grouped on a suitable stand. Signs placed on the exhibit stated that these irons are "relics of the past that bring back memories of sad ironing days when thousands of useless steps were taken between the hot stove and the ironing board."

Fig. 1—Display of Flat Irons Taken in Exchange.

Fig. 2—Exhibit of Ft. Worth Company at Fair.

Fig. 2 is a general view of the company's exhibit with the display of irons in the background.

Women Solicitors Prove Successful in Sheboygan.

The Sheboygan (Wis.) Railway & Electric Company has for some time been carrying out an ingenious plan for securing house-wiring contracts among the laboring classes, that has resulted in many new customers for the company. A lady solicitor, experienced in dealing with buyers of this class, was chosen from one of the department stores and instructed to call on all prospects. The lady of the house if at all interested in central-station service, invariably expressed the desire to have electricity but refers the solicitor to the man of the house who, of course, will not be home until evening. Such cases are immediately reported to the Company and a male representative calls on the prospect the same day the report was made, while the memory of the day's conversation is still in the mind of the house wife. The company's proposition is explained to the man of the house with the explanation that the housewife desired service but left the actual signing of the contract to him.

It is reported by W. B. Voth, superintendent of the company, that this plan of attack seldom fails.

New Office Building for Clarinda.

The Lee Electric Company, Clarinda, Iowa, contemplates the erection of an office building and store room to cost about $15,000. Rufus E. Lee, manager, would be glad to receive suggestions from other companies which have erected similar buildings.

SOME NOTES ON THE LARGE POWER RATE.

By E. D. Dreyfus.

No other single subject has compelled greater attention on the part of the central station within the last decade than the rate question. It has been searchingly studied by specialists and therefore most minds in the electric lighting industry. This endeavor has been a prerequisite to the rapid development of the central-station load which the past few years have witnessed. It will be found that the contributions from the "four corners" on the topic of rates and rate systems have reached great numbers, and in fact comprise in the aggregate a considerable volume, embracing its different phases attacked from various angles.

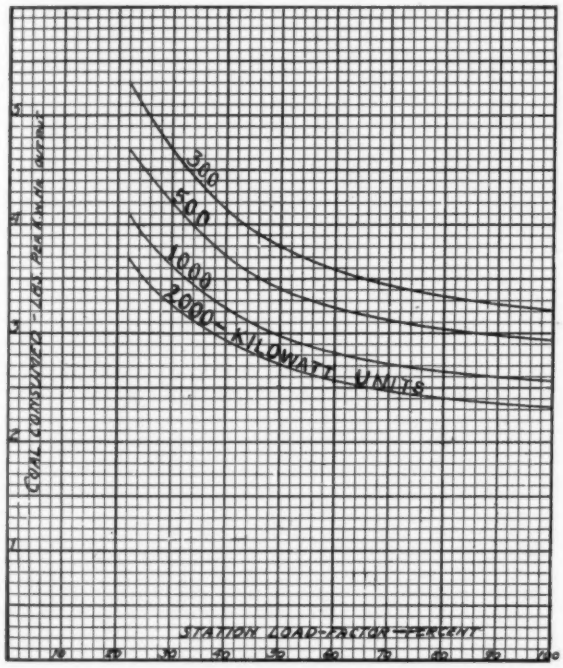


Fig. 1—Ideal Fuel Economies for Steam-Turbine Plants.

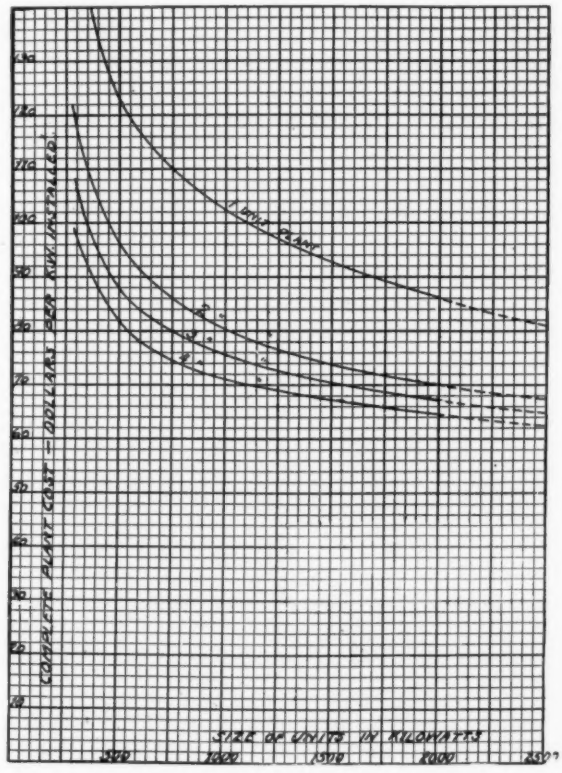


Fig. 2—General Costs of Steam-Turbine Plants.

The rate problem is a comprehensive one. Naturally it is constantly growing in importance as new requirements arise that must be met sufficiently and economically. A very significant movement was launched about two years ago by a body of rate experts centered upon effecting as great a uniformity in rate practice throughout the country as possible. As understood, of course, "identity" of rates for the different classes of service or that of different operating companies is not to be implied but "conformity" in the method of applying and presenting the required schedules is sought. There has been, however, a counter maneuver by opposing interests (the isolated-power-plant manufacturer) to secure the enforcement of strictly uniform rates by the State regulatory bodies, on account of the advantages that will thereby accrue to them, but this must fail by reason of its own defects.

There have been a number of arguments put forward recently, attacking the practice of differentiating between the large and small demand. This has been done entirely by those interested in some way in the installation of isolated power plants. The grounds taken are that the gradation of the charges is unfair, as it gives the large manufacturer the advantage, which it is claimed cannot be justified as it is stated that the only difference in the cost to serve is the proportionately greater expense of meter reading, collecting and inspection of the small consumer compared with the larger one, on the basis of the revenue returned. It is also contended that the adoption of the sliding scale or quantity discount is not in keeping with the spirit of the times, which is founded upon equitable treatment and a fair chance for all.

Let us for a moment test the logic of the following claims: (1) That the consumer who contributes the large volume of business is entitled to a better consideration when all economic factors are reckoned with; (2) the spirit of the time implies, according to proper interpretation, the greatest benefit to and development of the community at large. Plainly this is not to be attained by thwarting an industry in the mere endeavor to improve the situation with a certain class. This is radically wrong, and especially in the case of the electric utility, as the attempt acts to banish this possibility, due to loss of the large business which is responsible for substantial reduction in the average cost of production.

To force equalization of rates and thus place the large and small manufacturer on the same basis is utterly impossible. Either large or small consumer has recourse to the installation of a private plant, and, as clearly shown by the accompanying diagrams, the large user is not to be deprived of his natural advantage by enforcing uniform power rate. So it is immaterial how the rates may be arranged, the small manufacturer cannot be brought to the same level as the large consumer in matter of power costs.

But this is no calamity, as the rate reformers would have it inferred. In most manufacturing establishments, the power cost is usually less than 10 per cent of the production expense. When it is considered that the overhead in the small shops is relatively much less than in the large corporation, the ability to compete is not destroyed by a possibly small advance in the rate for power, and this is amply exemplified in the survival of the thrifty small industry; and we witness their expansion notwith-

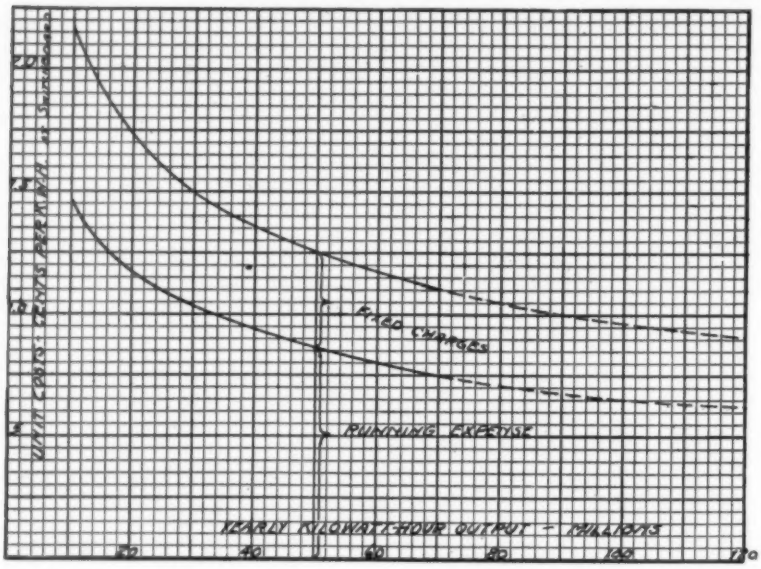


Fig. 3—Costs of a Central Power Station.

standing such differences as they might have to bear in obtaining their power.

A very formidable defense of graded charges, if such defense be necessary, is the fact that the small consumer may resort to the production of his own power if dissatisfied with the electric company's schedules. As already pointed out, the electric company is able to do better by the small manufacturer, by reason of the bulk business it secures through a descending range of prices. No business should be taken the revenue from which does not meet all costs, but the major part of the general and utilization expense may, with justice, be assigned to those classes which are inherently dependent more or less upon the electric company for its power supply, as it is the needs of such consumers for which the electric company must first provide.

To hold that the electric rate system should be reduced to the simple basis employed in the sale of gas and water is untenable for two reasons: first, the much-emphasized fact that in case of the supply of gas and water it is commercially feasible to minimize investment and to obviate standby losses by the employment of the necessary storage capacity which, in the distribution of electricity, is invariably financially prohibitive; second, the same competitive factor does not exist in case of gas and water supply. To drive wells or generate gas on the premises is far less likely or alluring than the operating of a small electric generating equipment. When a broad and reasonable view is taken, it will be found that the present electric-rate practice as herein expounded is a natural and logical outcome of the economic developments in the case.

Not only do we see the number of state public service commissions increase, but their activities and investigations are becoming more extensive. In the trail of these events we find the utility company exercising greater care in formulating its rates and taking pains so that it may justify any schedule or series of schedules it may issue.

Admittedly rate work does not submit itself to any scientific or refined treatment. Nevertheless, it may be prosecuted in a way as to conform with correct principles which will most completely produce the desired commercial and economic results.

On the whole, the rate situation is now being placed upon a most satisfactory basis. Companies are keeping detail accounts of the "outgo" and with a well arranged and selected classification such as adopted by the National Electric Light Association, proper apportionment of charges is secured, which enables the rate question to be intelligently and equitably handled. The principal differentiation of service to be noted is residence, commercial and power, and these again may be subdivided and subclassified. Residential schedules may be simplified to a large extent and likewise the commercial, although to a somewhat lesser degree. There is a gratifying similarity, in the main, of both residential and commercial rates throughout the country, and this will undoubtedly become more marked from time to time. Power service necessarily introduces the widest variation in which the locality, the specific nature of the industry served and the organization and layout of the electric power system have much bearing. In a section where cheap fuel obtains prices must accordingly be low. The factory or the mill with a large and comparatively constant demand necessarily earns lower rates than the small and irregular load. A utility company operating for the most part within the boundary of a metropolitan city may more readily equalize its power rates where its consumers are confined within rather narrow limits than a company consolidating the operation of a group of neighboring properties wherein each plant supplied virtually establishes a distinct cost-to-serve. It is necessary, therefore, that we distinguish these conditions and construct schedules accordingly.

There have already been a number of cases come up before the different state commissions in which the derivation of the base rates were shown, so that this phase of the problem need not be elaborated upon. Proceeding with the fundamental cost, a schedule which will at once be profitable and attractive to the large power consumer may be developed.

The outward character of the rate

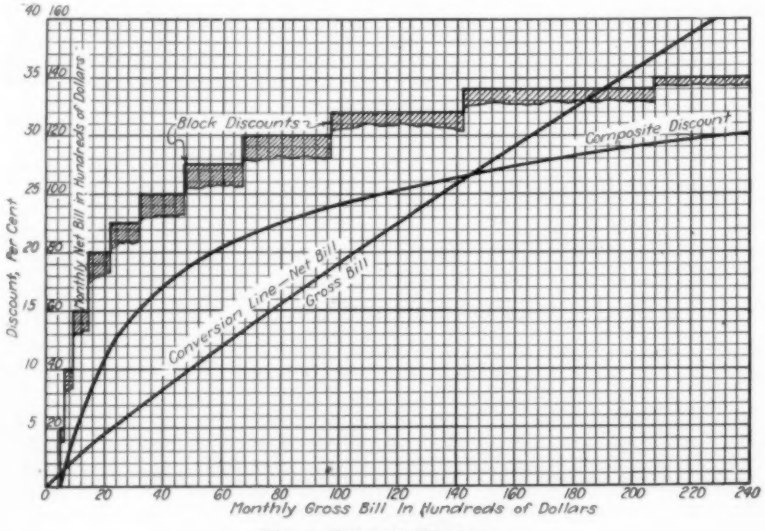


Fig. 4—Discount Diagram.

should have a part in the consideration along with the fixing of the net values that shall obtain. Primarily, two methods are in vogue in the arrangement of the large power schedule: first, successively descending scale of prices for both the demand and energy consumption, proportioned according to the extent of demand and quantity of energy consumed; and secondly, a fixed demand and energy charge with the combined charges subject to an increasing quantity discount; or as sometimes found, a combination of the two schemes is employed.

ses and deductions which shall be made the primary subject of treatment in this article.

Large business must be encouraged, as it has proved itself to be the vital sinew of the strength and growth of the central-station development. On the other hand, the returns from the business must meet all costs and carry a reasonable profit to the utility company.

As already noted, the different rates of the utility company cannot be derived with any great mathematical exactness, but nevertheless they are to be

this manner is fundamentally proper and has accordingly received the approval of the commissions and rate authorities, and is commonly known as the "expediency principle."

The situation is exemplified in the diagrams, Figs. 1, 2 and 3. Fig. 1 represents ideal fuel economies for varying size of steam-turbine stations burning coal. In Fig. 2 we have representative cost of well built and equipped plants of normal rating and possessing the proper reserve capacity. If the labor and supplies required in the operation of the plant are correspondingly analyzed and the total expense of the isolated power plant thus synthetically obtained, a marked gradation in the cost of the large and small plant is to be observed. In a similar manner, the unit economy at the switchboard of the central station will be found to steadily improve with the load and there will be an appreciable tendency downward as projected.

In the curve of cost of the power plant, it has been assumed that provisions are to be made in the initial installation for extensions, and this naturally affects the single unit layout in the

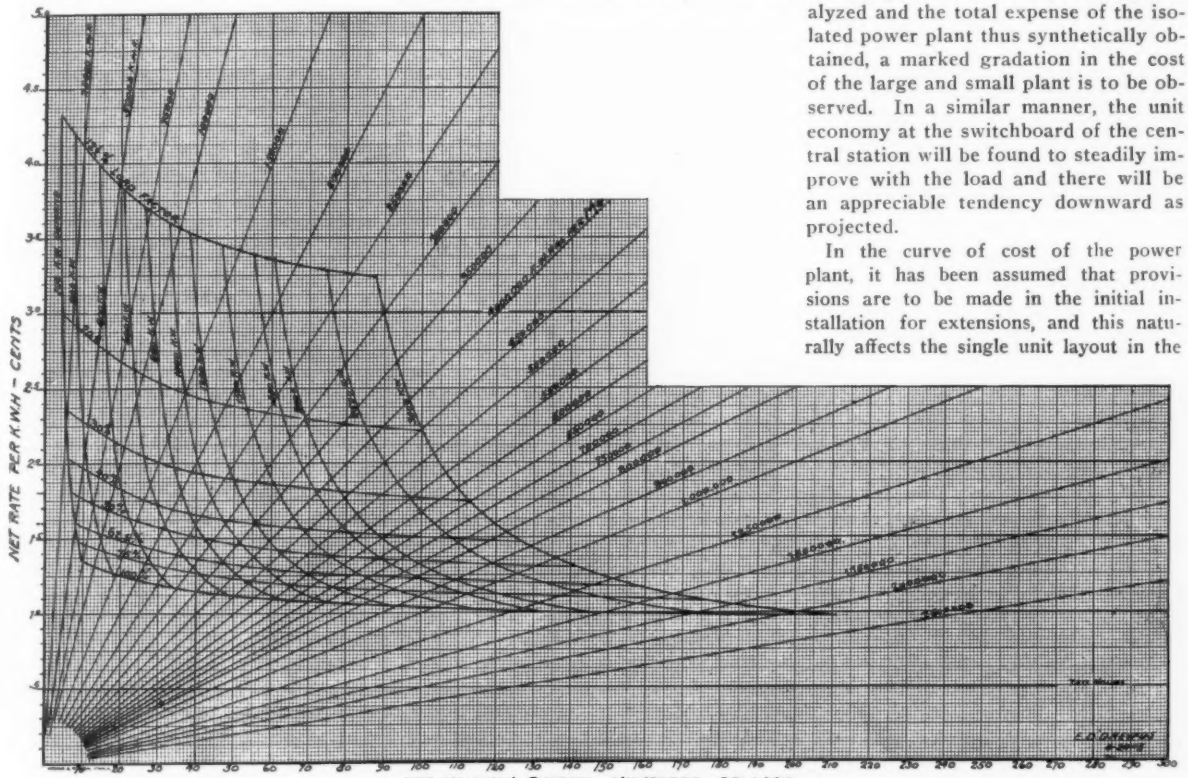


Fig. 5—Rate Diagram.

Both schemes possess merit and may coincide one with the other. The first is possibly in more general use, particularly in and surrounding the larger cities. Here central-station activity has hitherto been the greatest, and the large consumer in such regions is probably more accustomed to the features of such schedules.

The second scheme has this in its favor. In the determination of the gross charges the procedure is reduced to maximum simplicity. For consideration of quantity, block discounts apply, resulting in a uniformly diminishing unit charge. To the business man imbued with the idea of wholesale discounts (which is part and parcel of our commercial fabric) the second scheme will appeal strongly. It is also susceptible to instructive graphical analy-

logically determined from the typical costs and general results of the business. Experience, therefore, becomes a necessary part in the selection of rates. It is an established rule that the rates as a whole must range somewhere between the basic cost of rendering the service and the value of the service to the consumer. Thus the margin of profit may vary somewhat between the large and small classes. This is by no means discriminatory as at first may appear, as it is in the supply of large volumes of business that the highest degree of economy may be attained. The general reduction of operating expenses per unit of output following the furnishing of power in bulk directly redounds to the advantage of the smaller consumer.

The development of the business in

greatest proportion, as the diagram, Fig. 2, illustrates.

The ideal results have been employed in Fig. 1 as they naturally present the greatest regularity. Practical values, which are invariably very much in excess of these quantities, fluctuate so widely that unless it is known how the plant is or is to be operated no satisfactory determination may be made. To observe these "bench-mark" values increased 25 per cent or more is not uncommon, nor even doubling them is not necessarily extraordinary.

The "human equation" is a serious factor in the operation of a power plant. As well understood, there are so many conditions which may cause the economy of the plant to decline which are not apparent on the surface, that the results aimed for are not realized, conscientious

effort notwithstanding. But let the operating force prove negligent in any way, the efficiency falls off rapidly. Because a plant may run smoothly does not prove to be an indication of efficient operation. Not only faithful but intelligent attention is required in order to attain the desired results. Manifestly the quality of the coal and the character of the equipment are also instrumental in whatever showing the plant may make. These cautionary remarks are embodied herein so that the references the author uses and also their application may be properly understood.

As the subject does not contemplate covering any details of generating costs a discussion of this phase has not been undertaken.

Similarly the data in Figs. 2 and 3 are to be construed as very general. One only needs to examine the records from different plants and different sections of the county to appreciate the possibility of a wide disparity in such data, but its existence actually is too often very marked. They nevertheless show decided tendencies and therefore serve the purpose of this article admirably.

In Fig. 3 it is to be noted that it is taken for granted that the load-factor gradually improves with the increase in business, due to the diversity obtaining, and this is particularly true when the plant is small, so that the lowering of costs is very marked at this point.

From information of the kind outlined in the foregoing as a foundation, the rate-maker may construct a schedule for the large business. As the amount in dollars obtained from the business is so closely associated with the magnitude of the demand, the regulation of the prices proportioned to the extent of the demand and consumption may be advantageously established by a series of progressive discounts, the effect of which is interestingly exhibited later (see Fig. 5).

It will be assumed that the desirability of employing the two-rate method of charging is fully appreciated, as well as the steps necessary to obtain the demand charge from the investment in the property, the fixed charges thereon and the demand on the system; and the unit cost of the energy delivered, including the production, distribution and general expense. For the sake of illustration we will say that for a certain investment and operating conditions the assumed company finds itself in position to sell power in large quantities at a rate of $3.00 per kilowatt demand and one cent per kilowatt-hour for the energy consumed, which will be its starting point. Then from data of the nature given in Figs. 1, 2 and 3 and supplementary costs, a series of discounts is to be formulated as indicated in the following:

The first $500 of the gross bill, net; next $150, 5 per cent; next $300, 10 per cent; next $500, 15 per cent; next $750, 20 per cent; next $1,000, 22.5 per cent; next $1,500, 25 per cent; next $2,000, 27.5 per cent; next $3,000, 30 per cent; next $4,500, 32 per cent; next $6,500, 34 per cent; all excess, 35 per cent.

These are, of course, a combination of block discounts which will satisfy some one set of conditions, and are to be varied to take care of other requirements.

The preference for the *block* system of discounts over the *step* discount is taken for granted, owing to the avoidance of sudden breaks or depression in the charges when passing from the region in which one discount applies to the region in which the successive discount is in effect. The rate builder should endeavor to obtain smooth and gradual results through the operation of the block discounts. If the successive blocks of discounts bear a progressive and proportional relationship as shown by the shaded areas in Fig. 4, then the flexure of the composite discount curve becomes even throughout its entire range. There is no difficulty experienced in the practical application of these discounts. Short cuts may be employed to quickly obtain the net bill from the gross charges. A conversion line as given in Fig. 4 may be used, or, if great accuracy is necessary, a convenient table may be made up for the purpose.

It will be noted that the illustrations

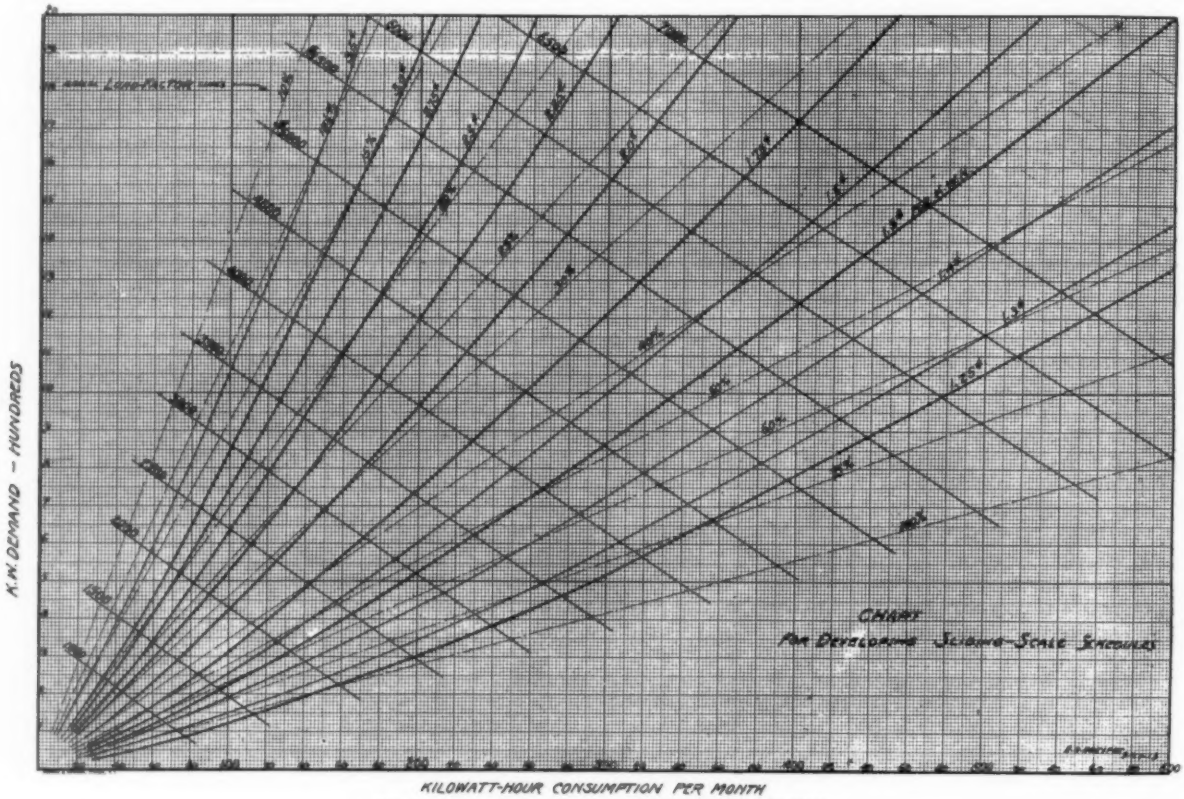


Fig. 6—Chart for Developing Sliding-Scale Schedules.

accompanying the article are simply diagrammatic and the values in one are not absolutely correlated with that of another, except as between Figs. 4 and 5. This is unimportant, as the attempt is to show the method only, and it would be of little consequence to have them reconciled in this article as the permutations by virtue of the different localities and conditions that must be taken into account allow only of generalities in an illustrative case of this kind.

The effect of arrangement above described becomes apparent in Fig. 5. This method of showing the manner in which the schedule in question operates will be found not only instructive but it will substantially assist the prospective consumer in grasping the true significance of the form of schedule discussed. As evident, large demands and high load reasons than those previously given. The other important item is the fact that the cost of copper may be as low as 50 per cent or less of the total expense of building the line, depending obviously upon what the company is obliged to pay for its right of way and easements, and the topography of the country as it may affect the cost of distributing the poles. Therefore, there will usually be found a large element of cost in the line that is fixed, irrespective of the load on the line. Consequently, the unit cost-to-serve in the case of the larger consumer will evidently be lower than with the smaller demand. Other less prominent factors could be cited, but sufficient grounds have been presented as a rationale for the above distinction in rates.

In plot (Fig. 5) the vertical ordinate has been the scale of net rates per kilo-

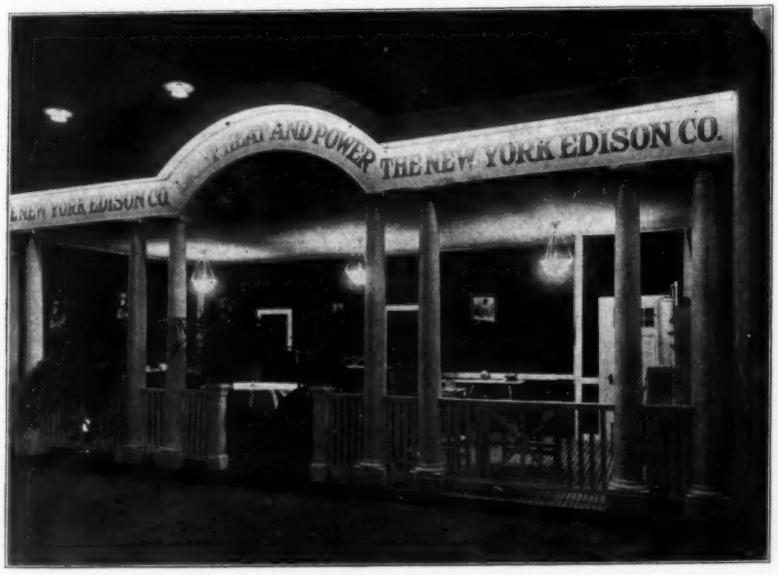


Exhibit of the New York Edison Company at the Woman's Industrial Show and Housewives' League Exhibition.

are properly recognized in these schedules in the way that the cost-to-serve justifies. It may be well to repeat at this point the fact that what might be termed large power and transmission companies (which ordinarily have to extend their circuits and pole lines considerable distances to reach its scattered consumers, in contradistinction to the metropolitan company which serves a concentrated load) must guard their business with more circumspection. Otherwise they may find themselves confronted with a condition where they will have attached unprofitable business. They can not raise the prices to an average or common level as they would stand to lose the large customer who, as already expressed, is needed to improve the general economic conditions of the entire system. In the case of the transmission company a descending scale of charges is warranted for additional watt-hour, and the horizontal, the monthly net bill in dollars. This allows of these two quantities being read more closely than divisions of kilowatt demand, kilowatt-hours and load-factor.

Should the first consideration be the kilowatt demand and kilowatt-hour consumption, the chart may be rearranged as in Fig. 6.

A more general use of diagrams is recommended, as they impress the mind more vividly than any other form or method. Some of the most interesting work of this kind was contained in an article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, February 11, 18 and 25, 1911, by H. E. Eisenmenger, of Cleveland, O. Three-dimension illustrations were employed, which pictured the rates as warped surfaces and which affords a splendid conception and comparison of different schedules. The form herein used is the more convenient for general use. It has a value in rate work analogous to the Mollier's temperature-entropy diagram in the design of heat motors.

New York Edison Company's Exhibit.

One of the most interesting features of the Edison Company's exhibit at the third annual Woman's Industrial Show and Housewives' League Exhibition held recently at the Grand Central Palace, was an electric doughnut cooking pan. Real just-like-mother-used-to-make doughnuts were cooked by electrically generated heat and the sizzling brown cakes were served to the visitors at the show.

The electrical exhibit included a model kitchen and dining room situated in the Edison Company's booth on the main floor of the Palace. The kitchen was fitted up with an ice box, kitchen cabinet, an electrically heated boiler, several of the best type irons, a washing machine, towel dryers and an electric range. The dining room was furnished with such electrical apparatus as chafing dishes, percolators, toasters and a vacuum cleaner. The lighting in the dining room was particularly attractive. A view of the exhibit is shown herewith.

A Large Dutch Wind Motor.

It is reported that a wind motor, claimed to be the largest of its kind in the world, has lately been brought into use at Harlingen (Friesland) for draining a "polder" (tract of lowland redeemed from the sea by high embankments) with an area of 1,850 acres. This machine, which has steel sails and is mounted on a steel tower, has a diameter of 50 feet and is said to be capable of dealing with 64,000 to 70,000 cubic feet of water an hour. It is an interesting fact that first the wooden windmills were replaced by explosion motors, but now again the steel wind motors are said to be more and more employed, especially in the draining of "polders."

Abolishment of Minimum Lighting Rates Proposed in New Jersey Law.

The New Jersey State Legislature is considering a bill recently introduced making it a misdemeanor for any person or corporation to receive, directly or indirectly, any payment of any kind for electrical energy which shall not have been actually used or consumed. The bill is designed primarily to prohibit electric companies from making minimum rates of $1, or other amount, as now generally done in the state, and collecting such amount regardless of whether service was rendered or not.

Electric Sign Data

Notes on Sign Flashers.

The electric-sign flasher has two advantages: it gives movement which attracts attention and enables one to secure spectacular effects; and it reduces the amount of current necessary to operate a given sign.

A moving sign (sign equipped with flasher) takes less current than one that burns constantly, but the maintenance of the flasher may affect this saving. For general guidance it should be estimated that moving sign saves 40 per cent in current costs—that is to say, a 1,000-lamp sign with a proper and well-designed flashing feature would take about the same current as a 600-lamp sign burning constantly, but the electric light bill will seldom follow this ratio because in all cases where the flasher fails to work the lighting company must keep the sign burning constantly. Also, into any estimate of current cost flasher and lamp maintenance must be figured.

A sign flasher, like any other piece of moving mechanism, requires inspection, oiling and maintenance. It will not run forever unless cared for. This does not mean that a flasher is a delicate instrument, for, as a matter of fact, all standard flashers are extremely hardy; but the sign salesman and the customer must realize that the flasher needs attention and that this attention, while it will save possible dissatisfaction, costs money.

Another point of importance is that the flasher manufacturer can give valuable advice in the matter of securing extraordinary effects, such as playing fountains, border chasers, spelling out of letters, etc. When something extraordinary is desired, it is well to get the advice of a responsible manufacturer. Furthermore, he can tell you a number of things that are impossible. There is a reasonable limit to flasher effects. Almost any effect can be secured at a price and by the use of specially designed machines, but it is obviously unwise to plan elaborate flashing effects for a comparatively small sign. The use of standard apparatus properly adapted to the problem in hand is always the cheapest and most effective.

In adopting a flasher, be sure that it complies with the Underwriters' rule. Violations of the rules may slip past careless inspectors, but "the game is not worth the candle." Here, as in the construction of the sign itself, there is temptation to cut costs, and the customer should be advised as to the exact merits of standard goods and the faults of those which may be secured at a cut price.

Flashers should be installed as directed by the manufacturer. He knows his business or he wouldn't be in it.

As a general principle, it may be said that flashers cannot be too good. Probably 75 per cent of flasher trouble has resulted from trying to use cheap or "amateur" flashers. The obvious thing, then,, is to secure all flashers from established sign manufacturers or flasher manufacturers of known responsibility.

To secure the best operating results do not screw either the flasher or motor down tight to the base. If you screw a flasher down tight, its base usually acts as a sounding board, especially if placed over storm doors or on a light partition. Always leave one-eighth of an inch clearance under the head of a screw that holds the flasher and motor, and put some rubber under both if necessary, otherwise it will be noisy. It is also not advisable to run a tight belt.

Electric sign particularly adapted for use by confectionery and drug stores. Sign as shown was manufactured by the Greenwood Advertising Company, Knoxville, Tenn.

Sign is double-faced, 9 feet wide by 7.25 feet high. 286 receptacles are provided.

The wording, "Soda," is made up of 16-inch raised spur block letters. The sign lends itself to a number of color schemes, the background being finished in imported glass smalt.

The fountain effect is arranged to flow continuously, the wording flashed as desired.

Electrical Construction

HUMOR AND PATHOS OF ELECTRICAL CONTRACTING.[1]

By J. A. Fowler.

The president of the National Electrical Contractors' Association has said that the electrical contracting business is a good business, but, like every calling in life, it has its elements of comedy and pathos.

Sometimes one is tempted to say that the fact of certain individuals engaging themselves in this business would be funny if it were not so pathetic.

The editor of the *National Electrical Contractor* presents a cartoon in the current issue describing a contractor who has secured two good contracts at a profit and his success has fired him to such a pitch that he is reaching out for everything else in sight with or without a profit. It very pointedly shows this greedy contractor in his effort to reach the profitless job stepping off the precipice of sound business into the river of adversity below.

Once I made an effort to reconcile two local contractors who had been at outs for a long time over a trivial matter and I had apparently succeeded when, as they were shaking hands, one said to the other, "Well, I wish for you all that you wish for me." Thereupon the other indignantly replied, "Now there you go starting it again."

Once a certain general contractor had occasion to let an electrical contract which figured to cost $8,000. The contractor had used an estimate of $10,000 from a local electrical contractor. After the general contractor had secured the work he proceeded to peddle the electrical work instead of letting it to the electrical man whose bid he had used. Working two electrical contractors against each other until the work reached a point where it had to be begun, he finally let the contract for about $7,400, which was $600 below cost. Had the general contractor more time, doubtless he could have had the electrical work donated. Both of the electrical contractors were large operators and probably had reasons for their conduct.

The habit of doing work below cost is one of the most pathetic conditions

Group at Recent Convention of Tennessee Electrical Contractor s' Association, Memphis, February 16 and 17.

[1] Address at convention of Tennessee Electrical Contractors' Association.

in the electrical contracting business today.

The most common cause finds its origin in the fact that the contractor either does not possess the experience needed to properly estimate his cost or he fools himself by not keeping a record of the work while it is in progress and thereby has no records for future work. But, of course, no one ever saw a contractor who kept no records but imagined he was making money. This method in time ruins the contractor and injures the creditors, but the customer profits, so we have an element of humor along with the pathos.

The second cause is that practice of contractors taking work below cost knowingly—either for advertising, expecting to get the customer's future business, or with an eye to the extras which may arise on the job. The contractor who pursues these methods is a dangerous element in the business. In his efforts to protect his losses he violates the terms of his contract, installs inferior work, thereby cheats his customer and exposes him and others to the attending dangers; or the contractor plans to rob his customer or his tenants on the extras that he expects to receive.

One value of organizations such as ours is being felt in the efforts we are making to rid the business of these dangerous citizens.

It is humorous to come across a condition where a certain building has been declared dangerous because of defective electrical work and the owner contracts to have the defects corrected with either a contractor who does not know or one who is dishonest and tries to get by the inspector, with the result in either case that the remodeled work is as bad, if not worse, than before the condemnation, and the customer has spent his money for naught. This rascality should be exposed and no professional courtesy should protect the guilty parties.

It is a pathetic travesty on our vaunted claim that we stand for "Safety First" when we make no effort to eliminate dangerous wiring conditions in hotels, rooming houses and workshops where the existence of these conditions is more dangerous than the presence of a store of dynamite. The dynamite would be well guarded, but who can guard defective electrical work? It can go off in a thousand places and at any time. Let not the fear that someone will say you have an ax to grind deter you from making public a knowledge of these disgraces. I know a number of property owners who will not patronize my concern because of my activity two years ago before the insurance interests to rid the city of dangerous risks from an electrical standpoint.

In the past one of the great pastimes of the business was the game of hide and seek which the electrical contractor felt he had to play with the inspector and the owner. This practice is now passing, due to the co-operative efforts of honest contractors, and while the time was when the inspector was forever warring, now it is the exception. As a rule, the contractor more than meets the inspector half way in their mutual effort to turn out work that will stand the test of time and be a monument to the honesty and integrity of the contractor.

J. A. Fowler Re-elected Secretary of Tennessee Association.

One of the most active men in the state of Tennessee in the electrical contracting field is Joseph A. Fowler, of Memphis. Mr. Fowler is a native of that city, having been born there in 1883. He started early in the electrical business and has now been following

J. A. Fowler,
Secretary, Tennessee Electrical Contractors' Association.

it for 17 years. For four years he has been conducting his own business in electrical contracting under the name of the Joseph Fowler Electric Company.

Mr. Fowler takes an active interest in the various contractors' organizations and is one of the leading spirits in his field. He has just been re-elected secretary of the Tennessee Electrical Contractors' Association, and is a director of the National Electrical Contractors' Association, representing his state upon the board of that body. He is also chairman of the Committee on Labor and a member of the Executive Committee of the National Association. He is a Jovian, and takes a prominent part in the activities of the local Jovian League.

It is not only in electrical affairs, however, that Mr. Fowler is active. He is one of the prominent business men of Memphis, and is a director of the Business Men's Club, as well as other local organizations.

Among the Contractors.

The Panama Theater in Philadelphia, Pa., has been wired by the Grossman Electric Company, of that city. The moving-picture parlor is one of the largest of its kind in the city.

The Beaver Engineering Company, Newark, N. J., has been awarded a sub-contract by the Essex Construction Company, contractor, for electrical work and elevators in the new Center Market building at a cost of $30,000.

J. C. Kinney & Company, electrical contractors of San Antonio, Tex., have recently finished the installation of the electric lighting plant for W. L. Crawford at Dilley, Tex. The Kinney Company has found it necessary to move into new and larger quarters at 233 East Houston Street.

The name of the Katterjohn & Dalbey Electric Company, Paducah, Ky., has been changed to the S. D. Dalbey Electric Company. The concern has purchased the building it is occupying and will remodel and enlarge it. The company plans to enter the jobbing trade, covering most of Western Kentucky. It also does a large contracting business.

The Seiffert Electrical Company, Evansville, Ind., has decided to establish a branch store at Henderson, Ky., across the Ohio River from Evansville. The concern plans to put into effect a motor-maintenance service in Henderson.

One of the most active electrical contractors in Chicago is J. L. Burgard, whose office and shop are at 751-753 West Fifty-fourth Place. Among the more important contracts now engaging his attention is the wiring and complete installation of nearly 400 ornamental tungsten cluster posts along Clark Street between the river and North Avenue. An apartment building with 60 three-room apartments at Drexel Boulevard and Forty-second Place is being electrically equipped in an exceptionally complete manner with lights, utility outlets and private telephones. A new four-story factory building for B. Kuppenheimer & Company is being completely wired at Western Avenue and Twenty-second Street. A new five-story factory at Ashland Avenue and Thirty-ninth Street will be wired for the P. A. Starck Piano Company. Other contracts recently completed or almost completed by Mr. Burgard's organization are a theater at Wilmette, Ill., a theater, hotel and store building at Lake Avenue and Hyde Park Boulevard and a theater and store at Seventy-fifth Street and Railroad Avenue.

A Unique Show-Window Device.

Fig. 1 illustrates a show window at 402 South Dearborn Street, Chicago, in which a unique advertising device has been installed by R. J. Suvan & Company. It consists of a flashing electric lamp mounted upon a plate of glass and without any visible metallic connection to any source of electric current.

Mr. Suvan is an electrical contractor who began business in Kalispell, Mont., and has done much work in various cities of the Canadian Northwest, but who is now devoting himself to the development of the new townsite at Biggar, Can. In this connection he is acting as sales manager for A. F. Brown & Company at the above address.

The show window here described has attracted a great deal of attention on account of the clever way in which the lamp has been mounted, and the lighting and extinction puzzles many a passerby. Like many other electrical advertising novelties, the action is simple enough when the arrangement is once understood.

In this case there are two paths by which current reaches the lamp and these operate in parallel to carry the current. The sheet of glass, while perfectly transparent, is coated with an invisible film of conducting material. This film is made by mixing up powdered blue lead, a compound similar to white lead, with shellac until a rather thick liquid results. This is applied to the surface of the glass and allowed to dry, when it will be found to be conducting. At the bottom of the sheet of glass, as will be seen in Fig. 2, this film makes contact with nails driven into the floor of the show window. These nails not only serve to hold the glass in a practically vertical position, but make contact with the films on the front and rear sides and convey current through the floor of the show window to wires which are connected below. This film, however, is not alone depended upon to carry current to the lamp. Fine copper wires of size No. 32 B. & S. gauge are run up along the edges of the glass from the floor to the porcelain receptacle which carries the lamp. By gold plating these wires are given additional carrying capacity and also protection. These wires are also covered in a coating of shellac on the edge of the glass, so that they are not noticeable. The porcelain receptacle was mounted upon the edge of the glass by sawing a slot in the base. This can be done by an ordinary hacksaw lubricated with turpentine. The lamp is a 40-watt tungsten lamp and the flashing is done by a motor flashing device concealed beneath the floor.

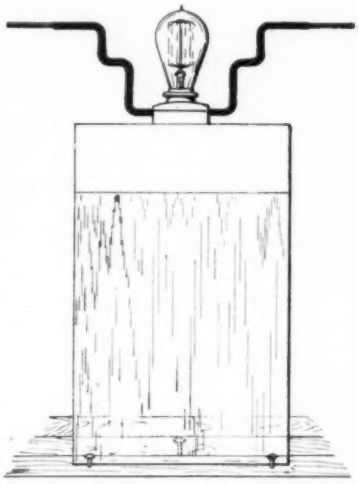


Fig. 2.—Lamp Mounted on Pane of Glass.

Other methods, of course, might be used for flashing, such as an electromagnet which breaks its own circuit and is made to operate slowly by means of a dashpot. Devices depending upon expansion by heat can also be used for this purpose, the circuit being broken when current has flowed long enough to heat a certain piece of metal which is included in the circuit, and being closed again when this has cooled down sufficiently to permit it.

Fig. 1.—Show Window With Electrical Display.

Removing Static Charge from a Belt.

I read with much interest William T. Estlick's letter concerning the removal of a static charge from a high-speed belt, in which the static electric charge was so great that it slightly deflected the course of the belt.

Another excellent way to eliminate static, and at the same time improve the pulling qualities of a belt, is to fill the belt with a harmless lubricant that will maintain proper moistness and at the same time make the belt so pliable that the pulleys will be firmly gripped. Castor oil and neatsfoot oil are sometimes used, but their action is in time deleterious to the belt. I use "cling-surface."

Slip on the pulleys and internal friction in the belt are the usual causes of static. Eliminate the causes and the effect will also be eliminated.

N. G. Near.

Detroit Inspectors Meet.

The second annual meeting and banquet of the Electrical Inspectors Club of Detroit, Mich., was held at the Hotel Richter on Thursday evening, February 5. Plates were set for 24.

The guests of the evening were F. R. Mistersky, city electrician, and A. T. Benallack, manager of the Michigan Inspection Bureau. Mr. Mistersky gave a very interesting talk on the evolution and efficiency of electrical inspection and Mr. Banallack spoke on fire hazards from electrical sources.

A report of the ninth annual meeting of the Western Association of Electrical Inspectors, held at Cincinnati, was then read by Ben. W. Clark, president of the association.

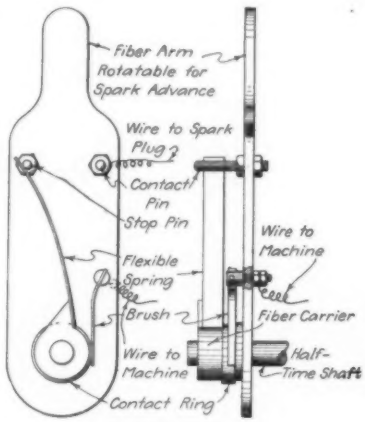
Contact Maker for Spark Plug.

Having had considerable trouble with battery and coil ignition on the single-cylinder stationary motor which I use in my workshop to furnish power for the lathe, drill press, grindstone, etc., I decided to replace the battery with a more dependable source of ignition current. My first thought was, of course, a high-tension magneto, but the high cost of an ignition device of that sort prompted me to think up a scheme to obtain magneto results without incurring magneto expense. Stored away with a number of other pieces of experimental apparatus I had a very simple frictional electric machine, and it struck me that the device when in condition gave a spark with practically the same characteristics as the high-tension magneto spark and equally efficacious for igniting combustible gases. I was, therefore, led to experiment with the machine in an endeavor to fit it for the purpose in hand and the results have exceeded my expectations.

The greatest difficulty was the provision of a suitable contact maker. The fact that the machine, rotated even at comparatively low speed, generated current at a potential sufficiently high for it to jump a gap many times as wide as the space between the plug electrodes necessitated the fitting of a "quick-make" device, so that the contact would be established practically before the spark had time to jump across the closing gap between the contact points. This was accomplished by fitting a flexible spring to the half-time shaft of the engine and arranging a stop pin to interfere with its progress until the spring was flexed to a degree where it would snap with great rapidity against the contact pin when the end slipped past the stop pin. How this was done is shown herewith.

A fiber arm was mounted on the half-time shaft in such a manner that it could be rotated through an arc suitable to accommodate the spark to any position between full retard and full advance; means were provided to hold the lever at the point set. Fastened to the half-time shaft so that it would rotate with it was a fiber carrier, in form somewhat similar to a cam and to which the flexible steel spring was fastened. This carrier was turned with a boss on the side facing the fiber arm and a brass ferrule or contact ring was driven on and connected to the spring by means of a short piece of wire; a brass brush supported by means of a post on the arm contacted with this ring, serving to conduct the current from the electric machine to the spring. Up above on the arm were mounted two pins or posts. The first one was the stop pin which served to retard the progress of the spring. It was so mounted that when the spring—a straightened piece of clock mainspring—first brought up against it, the length of the spring was a half-inch greater than the distance from the post to the other end of the spring on the carrier. Naturally, with this condition, the spring would lag behind the shaft every time it touched this pin until it was flexed enough for the end to slip past, when in an endeavor to make up for the lost time it would increase speed and bring up sharply against the contact pin. This latter was connected directly to the spark plug, so that when the spring hit it the circuit was established and the spark jumped the gap in the combustion chamber.

I found that it was not advisable to rotate the plate of the electric machine too fast, since the potential was enough to produce too large a spark. I also found that very much better results



Contact Maker.

were obtained when a Leyden jar was used with the machine. In this connection, I might add that the condenser made starting quite easy, for it was simply necessary to give the plate a couple of quick turns by means of the hand crank, slipping the belt, of course, when the energy stored in the jar was sufficient to produce the first good spark irrespective of the speed of the machine.

J. Naveman.

Alliance Electric Company Takes Over Mr. Eidlitz' Business.

The Alliance Electric Company, New York City, has taken over the business formerly conducted by Charles L. Eidlitz. Mr. Eidlitz, who was the first president of the National Electrical Contractors' Association and has been in the business for 26 years, has retired from contracting work, but the new company will continue the business at 1170 Broadway.

The Russell Electric & Machine Company, of Tucson, Ariz., has been awarded the contract for the electrical work in the new $100,000 Y. M. C. A. building to be erected in that city.

LETTER TO THE EDITOR.

Regarding Catalog Numbers and Designations.

To the Editor:

Will not some one please devise a system of numbering and naming articles which are as staple as sugar and which every one of the "57" miscellaneous manufacturers and the many jobbers each has a separate number for; why not, if nothing more can be done, list this material, like new Code cutouts and fuse material, as outlet boxes are listed with the same general reference and then have each maker's number so that one does not have to spend so much time looking up catalog numbers and what these numbers apply to; this could be done until some better plan could be devised to eliminate waste of valuable time.

Many manufacturers may object to this on the ground that their article is just a little better than that made by their competitors. Well, then let us establish a sort of "Good Housekeeping Institute" where all devices may be given a fair trial and a report rendered on same; if any device fails in any particular requirement, this defect could be corrected and finally a standard reached whereby the words "60 ampere New Code two-pole cutout" would mean one with a good solid porcelain base and phosphor-bronze contact clips and pure copper pressed lugs, and not a flimsy base and cheap brass or copper-plated metal work mounted on it to just pass the Underwriters' requirements and no more. They must try and be fair in the matter and cannot condemn an article on general principles, but if some standard were set and maintained it would not be long before every maker would be glad to bring his article up to this standard and the "cheap man" would not get a "look in" on the legitimate manufacturer who is trying to put out a good article at a right price.

E. M. Raetz.

Rochester, Minn., January 19, 1914.

A lease has been closed by the Avery-Loeb Electric Company, 114-116 North Third street, Columbus, O., for the entire five-story building which it now occupies, thus doubling its present floor space. The company secures possession on June 1. Through recent arrangement it is handling Westinghouse goods and orders from this territory are now filled here. To relieve congestion, the company has put in a mezzanine floor on which is accommodated part of the offices and a retail department. Among large contracts now under way are, a six-story building for the Hanna Paint Company, of Columbus, the Elkins, W. Va., and the Delaware, O., high schools.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Fishing Wires.

A scheme that I have found useful in finding wires in different places is to use a magnetized hook for feeling around and a fine iron wire attached to a weight for drawing the lead string down. With this magnetized hook one can easily feel the wire when close to it and it is drawn in without difficulty.

N. G. Near.

Knot For Lamp Cord.

A knot that will pull tight and lie flat like a washer slipped over the cord is valuable in wiring up lamp sockets

Knot for Lamp Cord.

and ceiling rosettes. An appropriate knot for this purpose is shown in the accompanying illustration. If pulled up evenly it will form a flat, solid knot.

Charles M. Stern.

Warped Cabinets.

I have experienced a great deal of trouble owing to steel cabinets which I have installed having their sides warped out of shape by lathers and bricklayers. The latter force their material against the cabinet and throw the holes in the lugs out of alinement with the holes in the trim, thus necessitating the redrilling of the holes, or at least filing them out on one side.

To overcome this, when roughing in I place the trim on the cabinet and then cut two pieces of wood about one inch square which will just fit inside the cabinet. These are forced into place vertically and horizontally, so that they keep the sides of the cabinet from being bent in. After the wire has been pulled in these sticks can be removed and the trim will be found to fit accurately.

A better method is to use metal strips with holes corresponding to those in the lugs and fasten these in place with the screws which will eventually be used to keep the trim in position.

John Shortt.

Drilling Holes in Concrete.

I have found the best way to drill large holes in concrete is to first drill

Special Drill.

a small hole with a three-quarter-inch star drill and then enlarge it to the desired size with a drill shaped something like a cape chisel. It is made from either a five-eighth-inch star drill or an ordinary piece of five-eighth-inch octagon tool steel forged out and dressed up as shown in the accompanying illustration.

H. W. Parsons.

Device for Testing.

The accompanying illustration shows a device that I find almost indispensable in

Needle Contact for Testing.

testing work. When testing for open circuits, grounds or short-circuits it saves stripping the insulation from the conductor. The device is made from an old 100-ampere-switch handle bored through its whole length to the diameter of a flexible lamp cord. The switch end is then bored to a larger diameter. A large sewing needle is then procured and the eye end is soldered to a length of lamp cord. This cord is drawn through the handle and the needle made secure by filling the large hole flush with the end with sealing wax or cement of the kind that is used in fixture work.

Robert Oster.

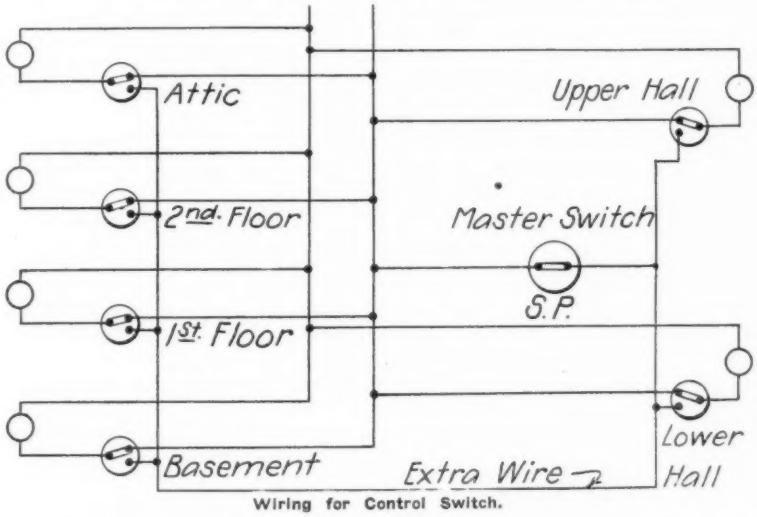
Making up Split Knobs.

A great deal of time can be saved by having split knobs made up beforehand ready for use. This is done by placing a leather head on a ten-penny nail; then put it through the knob and place another leather head on the projecting end, which holds the pieces of the knob together until ready for use. The shop boy can put these parts together in spare time.

P. H. Krantz.

Control Switch.

A master control switch can be put in a house which is already wired without excessive cost by replacing the single-pole switches by three-way switches and running one extra wire, as shown in the accompanying diagram.



Wiring for Control Switch.

W. C. Dee.

Removing Meter Pivots.

In the issue of October 25 George W. Martin gave a method for removing the pivots of meters when they are held up on account of the pivot or shaft being magnetized. I have tried this method, also spinning the disk, jarring the shaft, forcing the pivot in a wooden plug, and other ways, but find that none of them is as good as the following:

I use a short hook on the end of a meter seal or other convenient piece of wire and insert it into the jewel support, and upon turning the wire the pivot will fall out.

Charles E. Rietz.

Public Service Commissions

ILLINOIS.

Chief Engineer Appointed. Robert M. Feustel has been appointed chief engineer of the Illinois Commission. Mr. Feustel has been with the engineering department of the Wisconsin Commission, and has done independent construction work in many states as a member of the firm of Sloon, Huddle, Feustel and Freeman of Madison, Wis.

The Chicago & North Western Railway Company is authorized to issue $11,184,000 bonds for the purpose of paying of indebtedness and $10,000,000 equipment trust certificates to be used in paying for new equipment.

The Central Illinois Public Service Company was authorized to cross overhead with an electric distribution line the tracks of the Baltimore and Ohio Southwestern Railroad Company. It was ordered that a bill be presented to the Public Service Company in the sum of $5.00 for the expense of the Commission in making examination of such crossing.

INDIANA.

Arguments are being heard before the Commission in the Indianapolis Arbitration case between the street-car company and former employees. This case is occupying the Commission's time and little progress is being made in other matters.

Sale of Public Utility Bonds. In an opinion given the Commission, Attorney General Honan held that the Public Service Commission has no authority, under the Indiana Utility Statute, to authorize the sale of bonds of a public utility at less than 75 per cent of their face value, excepting only bonds authorized prior to February 1, 1913 and not issued. These may be sold, if the Commission so authorizes, at not less than 65 per cent of their value. The opinion also states that no utility can be authorized by the Commission to pledge its bonds as collateral for less than 75 per cent of par value.

MASSACHUSETTS.

Cambridge Electric Light Company. The Board of Gas and Electric Light Commissioners has approved the issue of 500 shares of new capital stock of the par value of $100 a share, at the price of $200 per share. The proceeds of 425 shares are to be applied to the payment of the Company's notes outstanding December 31, 1913, and of 75 shares to the payment of the cost of additions made subsequent to that date. At the beginning of the present year the company had notes outstanding to the amount of $85,000 on account of expenditures for additions to plant. The cost of further additions already determined upon will exceed the remaining proceeds of the stock approved by the Commission.

Haverhill Gas Light Company has been authorized to extend the gas service to the towns of Groveland and Merrimac, adjacent to the City of Haverhill. The selectmen of the two towns have voted to grant the company the necessary permission to open the streets. It appeared at the hearings that the company proposes to build at once distributing systems in Merrimac and Groveland, and to supply the former town by a high-pressure system and the latter by an extension of the present low-pressure distribution system in Bradford.

NEW YORK.

The Third Avenue Railway was authorized by the Public Service Commission First District to issue $4,000,000 in four-per-cent first refunding mortgage bonds, maturing January 1, 1960. The bonds are to be sold to net the company not less than 82 per cent of par value. An allowance is made of $720,000 for expenses in sale of bonds and for discount, but this amount is to be amortized by payment each year into a separate fund sufficient cash to accumulate the amount of $720,000 by January 1, 1959. Action was deferred in the additional $2,650,000 of bonds applied for by the company.

OHIO.

The Ashtabula Rapid Transit Company has been authorized to issue $40,000 of bonds to pay back money spent for betterments and improvements to the property. E. W. Doty, commissioner, dissents from the majority ruling holding that the capitalization is out of proportion to the needs of the road.

OKLAHOMA.

Gas and Electric Utilities. The Corporation Commission has issued its revised order requiring gas and electric utilities to report original cost of their properties and to file profiles and plates. The order contains the requirements as to classification of property accounts and the instruction to the company as to making the reports. These reports are to be filed with the commission July 31, 1914, as of June 30, 1914.

PENNSYLVANIA.

Free Passes. Administration Ruling No. 1 holds that the issuing of free passes to officers and employees of a railroad or street-railway company is not to be regarded as a violation of the provisions of the Public Service Company Law. This ruling gives some indication of the probable attitude of the Commission toward reduced rates for employees of gas and electric companies.

Telephone Investigations. The Commission has been working on telephone rate hearings and has adjourned until March 3.

RHODE ISLAND.

Narragansett Electric Lighting Company. Complaint has been made to the Commission alleging discrimination in electric power rates against manufacturers in Cranston.

WISCONSIN.

Mosinee Electric Light & Power Company. The Commission has issued an order readjusting the rates for lighting and power, changing the form of schedule. The minimum bill is reduced from 75 cents to 50 cents.

Village of Withee applied for authority to increase electric rates. The village is operating an electric plant which is privately owned, the object of such arrangement being that the city wishes to determine the cost of operation of the plant. It was ordered that the new rates be put in effect as fixed by the Commission.

Wisconsin Public Service Company of Fond du Lac was granted permission to purchase the property of the Minahan Electric Company also of Fond du Lac, and was authorized to issue $110,000 of first mortgage refunding five-per-cent gold bonds to be exchanged for a like amount of bonds

previously issued by the latter company.

Madison and Janesville Traction Company was authorized to issue $10,000 in stock, the proceeds from which are to be used in defraying the preliminary engineering and organization expenses incident to the construction of a line of interurban railway to connect Madison and Janesville.

The La Fayette County Telephone Company was authorized to issue $30,000 capital stock, $6,000 of which is to be exchanged for property of the White Oak Telephone Company.

The Richland Telephone Company was authorized to issue $20,000 of stock. The stock is to be sold for money only, and not less than the par value thereof as required by the statute. The proceeds of the sale of stock are to be used as partial payment of certain notes now outstanding against the company, such notes having been incurred on account of the construction of the telephone exchange and system.

American Telephone & Telegraph Arranges for Disposition of $30,000,000 of Western Union Stock.

The American Telephone & Telegraph Company has arranged with Kuehn, Loeb & Company, New York bankers, to underwrite the sale of $30,000,000 of stock of the Western Union Telegraph Company, held in its treasury. The stock will be offered to present holders of Western Union shares, and it is understood that Kuehn, Loeb & Company stand ready to take any portion for which subscriptions are not received.

By giving Western Union stockholders an opportunity to increase their holdings of telegraph shares the American Telephone & Telegraph Company officials maintain that no question can be raised of their sincerity in separating the two companies. The $30,000,000 of stock held by the American Telephone & Telegraph Company represents less than one-third of the outstanding Western Union capital, and the sale will mean a distribution of a minority interest among the owners of the majority stock interest in the company.

The sale of the shares will be accompanied by a promise that the dividend soon will be increased from three per cent to four per cent. The further hope will be held out of an increase later to five per cent, if the earnings of the company continue to increase as they have in the last few years. The American Telephone & Telegraph control of the Western Union brought with it a policy of making liberal application of earnings to the property for upkeep and additions.

Convention of Electrical Supply Jobbers' Association.

The midwinter meeting of the Electrical Supply Jobbers' Association was held in Washington, D. C., February 17, 18 and 19. Sessions were held at the Hotel Raleigh with Franklin Overbagh, general secretary, in the chair. An unusually large attendance was on hand and considerable interest was shown at all of the sessions.

An open session was held on Wednesday afternoon, at which J. E. Latta, of the Underwriters' Laboratories, Chicago, Ill., presented a paper entitled, "The Education of the Public in the Use of Standard Electric Wiring Materials." This paper, which makes a strong plea for the use of approved wiring devices and electrical supplies of all kinds, will be published in full in an early issue.

On Wednesday night Oscar W. Underwood, congressman from Alabama, addressed the meeting on the subject "Relation of Politics to Business."

One of the important matters taken up at the meeting was the question of applying for membership in the Chamber of Commerce in the United States. The Association decided by unanimous vote to become a member of the chamber, this action following an address by W. E. Robertson, of Buffalo. In his address Mr. Robertson touched upon the advantages to be gained from membership in the organization, representing, as it does, the principal business interests of the country. He stated that through membership the Electrical Supply Jobbers' Association would have the right to ask for a referendum of opinion among the business interests of the country in matters that may arise.

On Tuesday evening a rejuvenation of the Jovian Order was held at the Hotel Raleigh at which about 50 candidates were initiated into the order. The ceremony was in charge of Robert B. Patterson, statesman, Arthur Dunlop, statesman-at-large, John C. McLaughlin, secretary, W. B. Hadley, secretary, and C. A. Peterson, treasurer, of the local Jovian organization, assisted by the following committees:

Membership committee: Arthur Dunlop, Louis D. Carroll, George H. Maynard and C. A. Paterson.

Entertainment committee: John C. McLaughlin, Alan J. Bachrach, and Robert B. Patterson.

Rejuvenation committee: E. S. Marlow, Arthur Carroll, M. Du Perow, John R. Galloway, E. Gramm, W. B. Hadley, George H. Maynard, Julius M. Schneider and G. G. Webster.

Joviation committee: Thomas J. Fisher, Leo Brooks, Oscar Evans, Paul Lamberton, Arthur Dunlop, J. H. Finney, and T. L. Townsend.

Panama Canal Switchboards Described for Chicago Electrical Engineers.

A joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, was held in the room of the latter society on the evening of February 23, D. W. Roper presiding. E. W. Hewlett, engineer of the switchboard department of the General Electric Company, was scheduled to make an address on the electrical control of the lock machinery for the Panama Canal. In the absence of Mr. Hewlett, who had been called back to Schenectady, C. H. Hill, who was associated with Mr. Hewlett in the design of this equipment, made the address.

Mr. Hill described the general operation of the lock machinery and the reasons for making its control entirely electrical and of the remote-control type. The use of purely mechanical, hydraulic or compressed-air methods was not deemed feasible because of the lower efficiency of the equipment and the large operating force that would have been required. It was decided to concentrate the control equipment for each lock in a central control station in which there would be associated with the control switches a complete model of all parts of the locks. In this way interlocking of the control apparatus could be readily secured, the operations simplified so as to require the minimum number of employees and responsibility for all features of the operation centralized.

With the aid of numerous lantern-slide illustrations Mr. Hill described at length the various features of the electrically controlled equipment for the lock groups. He referred particularly to the control for the chain fenders, to the control of the valves in the culverts used for filling and emptying the locks, to the operation of the mitering gates, to the special position indicators and to the elaborate system of interlocks. The entire control equipment for the lock machinery was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 27, 1913, and will therefore not be referred to at length in this brief report.

Before closing his address, Mr. Hill had a series of moving pictures displayed in which the operation of one of the control equipments, that for the Miraflores locks, was made clear. The sequence of operations and the perfection of the interlocking system was thus demonstrated. The discussion of the subject was confined almost exclusively to a series of questions referring to details of the control equipment.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 200. — Electrically Operated Phonograph.—Is any phonograph on the market in which winding of the spring is automatically done by a silent electric motor whenever the spring tension gets down to a certain point? I believe several patents have been issued on electromagnetic release for a brake that stops the disk when the record has been played; has any device of this kind been applied to any phonograph on the market?—M. P. C., Jackson, Mich.

No. 202. — Rewinding Motor. — What size wire should be used to rewind a one-half-horsepower, 220-volt, direct-current, bipolar, shunt-wound motor to be used as a generator to deliver 15 amperes at 30 volts? How many turns should there be in each armature coil? How many feet of wire in the field coils?—G. R. L., Sioux Falls, S. D.

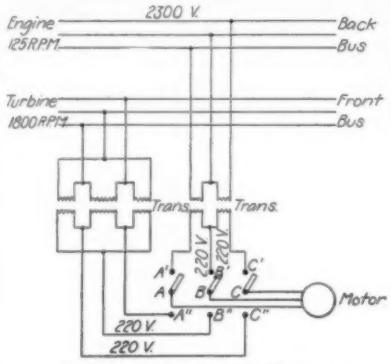
No. 203.—Service-Entrance Conduit. —When the wires of service companies are run aerial, would the Code require sealing the ends of the conduit that runs down the side of the pole and from the base of the pole underground into the basement?—G. R. L., Sioux Falls, S. D.

No. 204.—Highest Voltage.—What is the highest known voltage ever developed in any electrical apparatus?—M. L., Oak Park, Ill.

No. 205.—Lamps for Blue-Printing Machines.—What kind of lamps are best to use for blue-printing machines, carbon arc lamps or mercury-vapor lamps?—H. I. N., St. Louis, Mo.

Answers.

No. 194.—Motor Circuit.—In operating a hot-well pump, we use a 220-volt three-phase motor, which derives its energy from a bank of three five-kilovolt-ampere transformers that are in turn fed fom an outgoing power circuit. Any outside disturbance on this particular line would always drop the switch and consequently shut down the pump. In order to avoid this difficulty we used two transformers of 7.5-kilovolt-ampere capacity which were fed from the back busbars, the leads being clamped to them. The secondary leads were run to the upper and lower terminals of a triple-pole double-throw knife switch, using the hinge terminals for the leads to the motor, as per diagram herewith. At the time of phasing out so as to keep direction of rotation the same, one turbine-driven generator was operating on the front buses, and an engine-driven generator on the back buses. In testing we used two 110-volt lamps in series and from terminal *A'* to *A"* there was no light, from *B'* to *B"* no light, and from *C'* to *C"* no light, but from *A'* to *C"* the two lamps burned dimly. We could not secure any light from any other connection. Thinking possibly that the dim burning of the lamps between *A'* and *C"* was caused by the generators coming up to synchronism, we inserted the plugs, but they were nowhere near that point, as the lamps on the synchronoscope and the instrument itself plainly showed. I have tried this over a great many times with the same result, which I cannot account for. Can some of your readers explain it?—R. J. H., Mason City, Iowa.



No. 194.—Motor Circuit Diagram.

The writer begs to differ with E. J. R.'s answer to this question in the February 14 issue. In the first place he states that the maximum voltage would be 380 volts, whereas when the machines are within a quarter of a cycle of synchronism the voltage across the clips would be 440 volts. This I am inclined to think would hardly cause any current to creep across the switchboard through the dust thereon; if a metallic vein existed in the marble, it would be almost certain to show up. I believe that some connection will be found between some phase of the two machines, possibly in the synchronizing connections, that will cause this condition, either through a condenser action or through some metallic path.—J. H. M., San Francisco, Cal.

No. 196.—Speeding Up Street Cars.—If an electric street car designed for a maximum speed of 25 to 30 miles per hour is to be run part way in a rapid-transit subway at a speed of 40 to 45 miles per hour, can the motor and control equipment be readily adapted to the higher speed desired or must a motor equipment designed for the higher speed be substituted? Could this be accomplished satisfactorily by changing the ratio of the reduction gear?—B. F., Chicago, Ill.

You do not give enough data to answer your question, but as you are from Chicago I presume that you are interested in the project to run the present surface cars through the downtown district in subways. This project does not contemplate a rise in maximum speed of the cars, but an increase in the average schedule speed. The present maximum speed is 30 miles per hour. The average schedule speed is 9.25 miles per hour. By running the cars through subways in the downtown district the stops per mile and the headway could be reduced, causing an increase in schedule speed, which, in turn, would mean more seats per hour; under this condition the schedule speed would more nearly approach the maximum speed. With a maximum speed of 30 miles per hour, a loaded 25-ton car will require approximately 140 horsepower; to increase this to a maximum speed of 40 miles per hour would require about 200 horsepower if the heating effect was to be the same as before. The only means that can be used in your case to increase the maximum speed is to change the gear ratio. Having determined this, see if it is possible to operate the old equipment at the new loading without excessive heating. In the majority of cases this will be found impossible. An increase of gear ratio causes an increase in speed with a corresponding decrease in tractive effort with the same value of current or it gives an increased available maximum speed with an attendant increase in current, and consequently increased heating of the motors. As a rule, the tendency is to gear motors too high, causing heavier motors to be required and giving an excess speed that is hardly ever used. It is frequently the case that the motors are required for mixed service, and it is desired to operate at higher speeds in one part and lower in another; the motors are therefore geared for the higher speed, regardless of the fact that most of their operations are in the part where high speed is impossible. It can be easily proven that the maximum speed can not be economically increased without a change in motor equipment. At any rate in this particular case increased service will be had by reason of the decreased stops and slowdowns through use of the subway.—H. E. W., Chicago, Ill.

No. 197.—Long-Distance Telephones. —In order to have satisfactory conversation over a very long telephone line, is it necessary that the telephones used at the ends of the line be of exactly the same make, or is it sufficient to have them of the same general type and built for long-distance service?—U. S. P., Cedar Rapids, Iowa.

It is very evident that as the length of the line increases the sensitiveness and accuracy of transmission is decreased. This is also the case where cable is used in place of open lines for the same distance. It is also evident that, if the lines are of any length and are loaded, there will be less distortion of the voice waves.

The consequence of this would be that instruments of different make could be used. As a rule each manufacturer of telephone instruments has his own particular values of resistance, inductance and capacity in designing talking circuits. The induction coil has been the part to have the widest difference in design. If two instruments with induction coil designs that differ greatly in resistance and inductance are used, talking will be difficult even on common long-distance lines. If the instruments to be used are of different make I would advise checking them up as to similarity of induction coil, receiver and wiring. In long-distance telephony the attenuation must be reduced as much as possible, but especially so where the line has a number of distributed telephones of different type. Attenuation means the reduction of power during transmission, so that only a portion of the energy supplied to the line at the sending end will arrive at the receiving end. It is not only necessary to reduce the attenuation as much as possible but to also make the distortion a minimum. The sound to be transmitted is the superposition of many fundamental sounds of different pitches; correspondingly the current impressed on the line can be resolved by Fourier's theorem into a series of sine waves of different frequencies and phases. If these different sine waves are not attenuated all in the same proportion, the sound received at the receiving end will be distorted. To be on the safe side use instruments of the same make, if more than one is used per line or if there is no means of testing them. This would be my advice, too, if the line were very long.—H. E. W., Chicago, Ill.

No. 198.—Wiring for Electric Ranges.—In wiring up for a number of electric ranges and hot plates in a small hotel kitchen, is it necessary to run a separate circuit for each outfit or can several of the smaller stoves be put on the same circuit? The larger ranges would each take about two kilowatts and the smallest about 600 watts. My plan would be to put three of the small stoves on a circuit and make each circuit heavy enough for two kilowatts. Would it be necessary to put a pilot lamp on each circuit?—G. S. T., Winnipeg, Can.

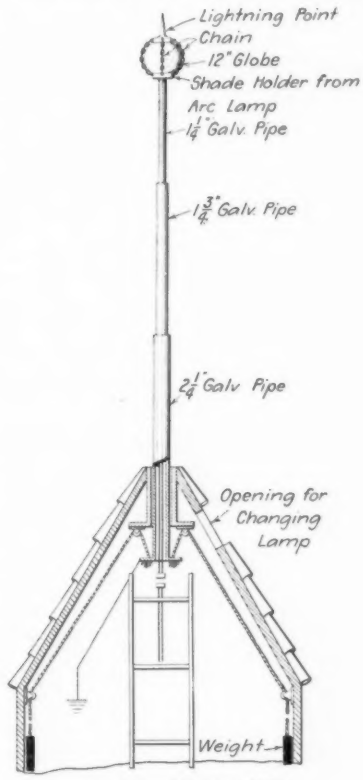
Your plan of putting three small ranges on a circuit and making all circuits heavy enough to carry two kilowatts is very good. If you wire each range separately it will mean a lot of extra wiring and expense. On the other hand, if you put too many on one circuit, in case a fuse blows or trouble appears on the circuit it will mean that all those stoves will be out of commission. Again, wiring all circuits very nearly alike will do away with carrying a stock of different sizes of fuses. A pilot lamp would be a desirable indication as to whether the current is on or off. In my opinion you have the right plan in mind.—W. T. E., Seymour, Conn.

In wiring for electric ranges for a kitchen the National Electrical Code states that "Each heater of more than six (6) amperes or 660 watts capacity must be protected by a cutout and controlled by a switch or plug connector plainly indicating whether 'on' or 'off' and located within sight of heater." If small heaters are grouped so that they do not require over 660 watts they can be protected by a single cutout and fused to 10 amperes. The proper method and the one costing the least would be to run a set of three wires as feeds (if a three-wire system is used) to a central point in the kitchen and distribute to each range or group of heaters with a separate feed protecting each feed with a knife switch and cutout. Switches should be in plain view of the range and it would be well to install a small red lamp in the circuit so same will burn when the heating device is in use. A main switch should be inserted in the main feed so that the entire equipment can be disconnected. All feeders should be of ample size so that when the whole equipment is in use the voltage will not be less than that for which the apparatus is designed.—C. T. P., San Francisco, Cal.

As each of the heating devices would consume energy amounting above the Code lighting-circuit limit it would be in violation of the Code to connect them on a lighting-circuit branch. Hence a special heater circuit would be used, and it is immaterial whether the heaters are all put on one branch or a branch run for each individual heater or group of heaters, if the wire is large enough to be protected by the fuses used. The advantage of separate branches for each heater is that in case of trouble in one heater it can be isolated from the others and not cripple the entire service. There would also be an advantage in that a smaller fuse would be used to protect each heater, which, in case of trouble, would prevent as great a flow of current through the fault as would be the case were several of the heaters on one branch. Considering the size of the heaters and that they would probably be under a close watch I would not use a pilot light, but would insist that an indicating switch be used and mounted in plain view from any point where the chef might be.—H. E. W., Chicago, Ill.

No. 199.—Steeple Lights.—We have a proposition of putting an electric light on top of a church steeple which is extremely high. The nearest opening to the top of the steeple is 30 feet below the apex. I should like to inquire through your columns whether any contractor ever had a job of this kind and as to how he arranged things so that the lamp would be protected from hail and easily lowered for replacement, so as not to require the frequent services of a steeple jack. Being a church tower, any device installed must, of course, be of sightly nature.—F. W. R., Freeport, Ill.

We have installed a light pole on our new fire station which extends 25 feet above the top of the tower; the problem was somewhat similar to that of F. W. R., but we could make an opening near the top. When an alarm comes in from any of the boxes or telephones the red lamp on top of the pole is automatically lighted and continues to burn until it is known that the fire is extinguished. As shown in the accompanying sketch, the pole is made up of three pieces of galvanized pipe to give it strength and a tapering effect. The pole is slightly overbalanced by having steel ropes pass from the flange at the bottom of the pole over pulleys to counterweights that hang in the tower. The lamp is near the middle of a heavy 12-inch alabaster glass



No. 199.—Steeple Light.

globe that is secured in a shade holder from an old Fort Wayne arc lamp. On top of the globe is a lightning point connected by four chains with springs to the shade holder, which is tightly connected to the top of the pole. Near the bottom the pole is connected to a well grounded copper lightning rod protected all the way by one-half-inch conduit. The latter is not shown in sketch. The wires for the lamp in the pole end in a receptacle at the bottom which is connected by a short flexible jumper with plug to the lighting circuit coming up from below. A small opening, like a porthole, gives access to the globe and lamp when the pole is disconnected from the jumper and lowered.—P. O. H., Sioux Falls, S. D.

The Public and the Telephone Service of a Big City.

In a recent issue of the *Tribune*, of Chicago, Ill., several articles have appeared relating the difficulties and complaints which are made from time to time in the relation of the telephone company to its patrons in Chicago. These articles have been written by Henry M. Hyde, who has published the following interview with H. F. Hill, general manager of the Chicago Telephone Company in the *Tribune*, setting forth the company's side of the question:

"It will always be the easiest thing in the world to attack the service of the Chicago Telephone Company in the newspapers.

"The average daily number of telephone calls in Chicago is 1,800,000. These calls come from more than 340,000 separate telephones. Each of them is handled by two of our more than 6,000 operators,

"If each operator makes one mistake in every hundred calls she handles the total number of errors will be 36,000 a day.

"In other words, if the work of our operators was 99 per cent perfect there would still be 36,000 people every day who would have a more or less legitimate reason for complaint.

"We have not yet succeeded in reaching such a high standard, though we are working towards it and we keep continually trying to cut down the number of avoidable errors.

"Since last October our careful tests show a slight, but steady, improvement in the service. At present we have set our standard at 94 per cent perfect. If, for any reason whatever, we find that more than six per cent of errors are made in handling our 1,800,000 calls per day we feel decidedly uncomfortable. If we succeed in cutting down the number to below six per cent we are correspondingly encouraged.

"We have several ways of keeping daily track of the quality of our service. The most important is the observation switchboard. It is located here in the main offices of the company and is manned by our most expert and accurate operators.

"Fifty or 60 of the busiest lines in one exchange after another, all over the city, are switched on to this observation board and every call going over them is watched and recorded. With a stop watch before her the observation board operator keeps a record of the exact time elapsing between the calling of a number and the completion of the connection. If there is delay we investigate the cause and take steps to prevent its recurrence.

"As a result of this careful work, which goes on continually, we are able to get 96 per cent of all our calls answered in 10 seconds or less. The average time occupied in completing a connection is only four seconds.

"It is interesting to recall that not many years ago a telephone connection that was completed in 30 seconds was called speedy. And I can recall when a minute was not considered an unusual time in which to get the desired number. The public demand for prompt action grows with the improvement in our service. We are doing our best to keep pace with it.

"At the same time the observers keep track of every error which is made in handling the calls going through the board and trace each to its source.

"The most common error is that which results in the subscriber getting the wrong number. Our tests, carried on over a series of years, show that about one-third of such errors result from the subscriber giving the wrong number, or the wrong exchange, to the operator. The other two-thirds are due to the mistakes of our operators. This percentage is just what would be expected when one knows that in each call one subscriber and two operators are involved.

"The chance for error in selecting the exact number wanted out of 350,000 possible numbers is enormous and it is, it seems to me, remarkable that 'wrong numbers' result in only three and one-half per cent of the total number of calls.

"Altogether we put from 12,000 to 15,000 calls under the microscope every month, and in the course of a year we are able to get a very fair check on the service in each of the territories served by the thirty branch exchanges in Chicago.

"A telephone company is under a great disadvantage in working to improve its service. The product of an ordinary factory can be put on the table, weighed, measured, and tested by the inspection department to determine exactly how close it is to the desired standard.

"A telephone company sells facilities for conversation, which is completed in a few minutes and which leaves no traces behind it. The tests must be applied while the connection is being made. And there are few, if any, lines of business in which 1,800,000 transactions are completed every 24 hours, in each of which there are three human factors involved—one subscriber and two operators.

"The telephone company cannot, of course, control the action of the subscribers—except to point out, as we have done, the various ways in which it is easy for a subscriber to make a mistake. So far as our 6,200 operators are concerned, we exercise the greatest care in their selection and training and we have left nothing that we can think of undone to make the conditions under which they work conducive to accuracy and speed.

"Incidentally, I feel that the young women who operate our switchboards will average as high in intelligence and devotion to their work as any similar number of employees in the world.

"As an evidence of how careful we are in selecting operators I may say that out of 4,800 applicants for positions in our service during the last year only about half were able to pass the searching mental and physical tests to which all candidates are subjected. And before the school term was over about 800 more dropped out, leaving 1,600 of the most fit to complete the course.

"All the pupils admitted to our training school are paid from the start. We furnish to them and to all our operators—simply as a matter of good business—a warm luncheon during the noon hour. The young ladies work eight hours a day with 15 minutes for recreation at the end of each two hour period. We employ six visiting nurses, whom the operators are invited to call on for assistance in case of even the most trifling ailment. Many of our exchanges are equipped with roof gardens, where the operators may catch a breath of fresh air during the summer recreation hours. At other exchanges we have fitted up outdoor gardens, with benches, swings and other facilities for recreation.

"We employ no young ladies who are not at least 16 years old, and the average age of our operators is 20 years.

"We should be glad to have suggestions as to what we can do to further improve the efficiency of our working force. We invite the co-operation not only of the public but of the municipal complaint bureau.

"It is impossible that prompt and perfect service should be of more importance to any of our subscribers than it is to the Chicago Telephone Company."

Prizes for Fiftieth Anniversary Celebration of Columbia School of Mines.

Three prizes have been offered by the Committee on the Celebration of the fiftieth anniversary of the School of Mines, Columbia University, two of which are open to all graduates of Columbia, and the other open to all. The prize open to all is $100 for a poster which shall fittingly indicate the anniversary, and the judges will be

Austin W. Lord, dean of the School of Fine Arts at Columbia, Edward H. Blashfield, and Robert W. Chanler; designs must be submitted on or before March 15. The other prizes are $50 each for a Columbia song, and a Columbia poem, for which entries will close May 1. All competitors must send their work to Frank D. Fackenthal, secretary to the Committee, at the University. The judges of the poems and songs will be John Kendrick Bangs, Brander Matthews, John Erskine, Frank Dempster Sherman, Walter Henry Hall.

Plans are practically completed for the celebration, which begins on May 28 with a reception in the gymnasium at which the alumni will be welcomed by the president of the University, the dean of the School of Mines, the senior professor (Henry S. Munroe), the chairman of the Celebration Committee, and others. In the forenoon of May 29 there will be a big meeting in the gymnasium at which President Nicholas Murray Butler will preside, and degrees will be given to prominent alumni of the School of Mines. It is also expected that there will be sectional meetings of the various engineering graduates in the afternoon, with the first lecture in the Charles F. Chandler Foundation by an eminent chemist, at which Dr. Chandler, the last survivor of the founders of the School of Mines, will preside. The celebration will close with a banquet at the Waldorf-Astoria at which prominent graduates will speak.

N. E. L. A. Exhibit Committee Formulates Convention Exhibition Plans.

A meeting of the exhibition committee of the National Electric Light Association was held at the offices of the Association, New York City, on Monday, February 16. Those present were J. W. Perry, H. W. Johns-Manville Company; W. M. Skiff, representing S E. Doane of the National Lamp Works of the General Electric Company; L. W. Shugg, representing F. H. Gale of the General Electric Company; W. C. L. Eglin, representing President J. B. McCall of the National Electric Light Association; T. Commerford Martin, secretary of the National Electric Light Association, and secretary of the Exhibition Committee, H. G. McConnaughy.

The proposition of the Bellevue-Stratford Hotel was accepted for the meetings of the National Electric Light Association and headquarters, also for the exhibit of the Class D members.

Contracts were let for the decorations of the roof of the Bellevue-Stratford for exhibits. These will be the most unique and artistic ever attempted by the Association. It is considered that the top floor of the Bellevue-Stratford Hotel, which will be used exclusively for exhibits, and the restaurant is the most complete and artistic roof in the world. Many of the rooms are 30 feet high, all enclosed, with a view for miles over Philadelphia from any of the windows. The decorations as planned by the exhibition committee will be in keeping with the beautiful decorations of the various rooms.

The exhibition committee will send out a general letter together with duplicate information cards and it is hoped that every prospective exhibitor will fill out these cards and return them promptly to the secretary of the exhibition committee. Application blanks and plans with details will go forward as soon as they have been completed.

The Philadelphia Electric Company will make every effort to complete details looking to the comfort and satisfaction of the visitors. Mr. McCall is giving all plans for the convention his personal attention and is looking forward to a banner convention.

Controversy Over Power Sites in National Forests.

The Beaver River Power Company and L. L. Nunn were made codefendants in a suit in equity instituted at Salt Lake City, Utah, by the Federal Government on grounds similar to those which formed the basis of the suit still pending against the Utah Power & Light Company. The action involves the right of the power company to occupy and hold possession of lands within a national forest reserve for the development and transmission of hydroelectric power without having obtained permission from the Department of the Interior and the payment of a rental.

It is alleged that since July, 1911, the defendants have engaged in the operation of hydroelectric power works located on what is now designated as the Fillmore National Forest without having secured permission from the government to do so. Its existance on the land is alleged to be a trespass.

The camplaint asks that the defendants be required to secure permission for the possession of the lands and also to reimburse the government for a reasonable amount as rental during the period of the past occupancy.

The case opens up the whole subject of federal and state control of the public domain. The power companies hold that they are entitled to the lands under the federal act of 1866, while the government contends that the provisions of this act which provided for the occupancy of the public domain for power sites were repealed by implication contained in the later federal act of 1896, which laid down regulations by which easements for limited terms of years could be secured.

The first case to be brought under the government's construction of the law governing such power sites on the public domain was that against the Utah Power & Light Company. The decision rendered in the United States District Court at Salt Lake City was in favor of the defendant company, but on an appeal to the United States Circuit Court of Appeals, the decision of the lower court was reversed last October. The case is still pending on a motion for a rehearing before the Court of Appeals.

Railway Electrification in England.

On February 12 the Institution of Electrical Engineers held the first of a series of meetings arranged for the discussion of various aspects of electric traction, at London, Eng. The subject was opened by Roger T. Smith who generalized on some of the railway conditions governing electrification, especially in England, and covered in turn, (1) urban and suburban passenger services, (2) fast passenger service, and (3) freight and mineral traffic. The next meeting (February 26) will consider "Motor and Control Equipment for Electric Locomotives," by F. Lydall, and "Rolling Stock and its Design and Influence on the Energy Consumption of Trains," by H. E. O'Brien. March 12 will be occupied by Professor Miles Walker with "The Design of Traction Motors for Alternating and Continuous Currents;" April 2, with "Electric Signallig on Railways," by H. G. Brown; and the series will be brought to a conclusion on April 23 by "Electrification of Railways as Affected by Traffic Considerations," by H. W. Firth.

Electric Cooking in Boston.

The Edison Electric Illuminating Company of Boston, Mass., is making a rate of three cents per kilowatt-hour for heating and cooking load when connected on a separate meter. The company has recently issued folders to its customers calling attention to the advantages of electric ranges and stating that the average cost is about $1.00 per person per month. The cost of operating at the above rate is said to be equivalent to cooking with a gas range with gas at $1.10 per thousand cubic feet.

One customer who is using the Simplex range has stated that 165 kilowatt-hours were used in preparing 216 meals, or about 2.3 cents per meal.

THE HYDROELECTRIC POWER SITUATION IN THE NORTHWEST.

By J. J. Wettrick.

By way of introduction, a short resume of the situation in the United States as a whole would, perhaps, not be out of place.

In a report prepared in 1908 for the National Conservation Commission, the United States Geological Survey estimated the total water power of the United States on bases of what are practically equivalent to maximum continuous power for the average year, and the maximum continuous power for six months of the average year, at 40 million, and 67 million horsepower, respectively. This estimate makes no allowance for storage.

An analysis of the estimate on the above basis shows that it is very likely too high and the Survey states expressively that its estimate be interpreted for future availability, rather than present possibility:

"The schedule shows, therefore, what will be the maximum possibilities in the day when our fuel shall have become so exhausted that the price thereof for the production of power is prohibitive, and the people of the country shall have been driven to the use of all the power that can reasonably be produced from the streams."

Anticipating future improvements in water wheels, the estimate is based on the assumption of 90 per cent efficiency of power on the turbine shaft as against the usual rating of 75 or 80 per cent. A further probability of error when viewed in the light of present conditions and practice, exists in the use, in calculating the theoretical power of the various streams, of 90 per cent of the total fall in the section or sections constituting units for development into which the streams were divided. Taking, then, the latter at 80 per cent and the former at 75 per cent, we get a value equal, approximately to 74 per cent of the above amount or approximately 30 million horsepower for maximum continuance for the average year, and 50 million horsepower for maximum continuance for six months of the average year. It must be borne in mind that these figures do not include storage possibilities.

Various estimates have been made of the total water-power possibilities of the United States based on storage, but none of them are of a nature to inspire confidence in their accuracy, due to the fact that they are based on insufficient data. An estimate based on storage is dependent upon so many factors, such as storage capacity, value of land to be submerged, possibility or feasibility of constructing dam, cost of dam, stream flow, etc., that any reasonablly correct estimate would involve a careful survey of every project in the country. Probably the best estimate available is one contained in the report of the United States Geological Survey above referred to, and is by M. O. Leighton, chief hydrographer of the Geological Survey. He says, after some explanatory remarks as to how he arrives at the amount, "It may be assumed with confidence that, were all practical storage sites utilized and the water properly applied, there might be established eventually in the country a total power installation of at least 200 million horsepower." It is not clear from the statement, but this probably does not mean continuous power, but the total installation that under common practice would be considered economical.

The total rated capacity of all the "prime movers," steam, gas, waterwheels and electricity used in all the manufacturing industries in the United States in 1909 was 18,657,000 horsepower. Assuming that every one of these prime movers at some time during the year is running at full capacity, which, however, is hardly probable, and using a diversity-factor of 1.5, we get a result of 12,450,000 horsepower as the required central-station capacity to furnish all the power consumed in the manufacturing industries in the United States in 1909. This does not take into consideration the power loss between central station and consumer, which would probably nearly balance with the excess of the total rated capacity of the prime movers over the power actually developed.

Comparing this result with the 200 million horsepower as above stated, it will be seen that the total waterpower of the United States, if developed, could furnish 16 times the power now consumed in all the industries in the United States, except those of lighting and transportation, and the lighting industry may be disregarded because the power consumed therein can be generated with installations that would otherwise be idle, due to the fact that the great majority of other industries are idle, while power is consumed for lighting.

Coming now to the subject matter of the paper, the term "Northwest" is generally held to include the states of Oregon, Washington, Idaho, Montana and Wyoming, but with the exception of a few general statements, this paper will deal with a more restricted Northwest, namely the northwestern part of the State of Washington, or the Puget Sound region.

The United States Geological Survey places Washington first among these states as well as among all the states of the Union, arranged in order of amount of waterpower possessed, with 10,376,000 horsepower on a basis of maximum continuance for six months of the average year. Next is California with 9,382,000 horsepower, then follow in order Oregon with 7,935,000 horsepower, Montana with 5,197,000 horsepower, and Idaho with 3,080,000 horsepower. The maximum continuance power for the entire year in each case is approximately one-half of these amounts. These states in the order named head the list of all the states in the Union. These amounts are subject to correction as above described and for the reasons given, but the foreging and following comparisons will hold true nevertheless. The total for these five states is 58 per cent of the total given for the entire United States, and the amount allotted to Washington is almost 17 per cent of such total. It should be remembered again that these figures do not include storage possibilities, and they constitute for the greatest part a very rough estimate, due to lack of accurate data.

The water power tributary to the Puget Sound region I have arbitrarily assumed to be the power found in the streams of the western slope of the Cascade Mountains from the Columbia River to British Columbia, the eastern slope of the Olympics, the Klickitat River and one-half of that in the Columbia River between Celilo and the mouth of the Cowlitz River. There are many good power sites capable of large development on the Yakima River itself that are nearer Seattle and Puget Sound than some of those included in the above territory, but it is thought that this power can readily find profitable employment in the commercial and irrigation industries in the great region to the east of the Cascade Mountains.

In the region above described, reports of the United States Geological Survey (on bases of maximum continuance power on the turbine shaft) give the rivers flowing into the Columbia, including the Klickitat, White Salmon, Little White Salmon, North and South forks of Lewis River, the Toutle and Cowlitz Rivers a total of 494,550 horsepower. Investigations show that with economically possible storage this amount could be doubled, making a total of approximately 989,000 horsepower continuous.

The Nisqually, White, Puyallup and Cedar Rivers are given totals of 215,970 and 127,280 horsepower, according as they are considered with or without storage. Continuing on north are the Snoqualmie with 60,000 horsepower, Sultan River with 25,000, the Whitechuch, Sauk, Skagit, Nooksack, Still-

aguamish, Skykomish and other small rivers for which no government estimates are avilable, but which would in all probability furnish in the neighborhood of 300,000 horsepower.

On the eastern slope of the Olympic Mountains is the Lake Cushman project which has been estimated to be capable of development anywhere from 30,000 to 150,000 horsepower continuous. The Elwha River, on which an 8,000-horsepower plant is now practically completed, according to estimates of competent engineers, is capable of development to the extent of furnishing 35,000 horsepower continuous. Other streams in the eastern portion of Clallam and Jefferson Counties have been estimated to be capable of furnishing 50,000 horsepower continuous.

Then there is the Columbia River, the greatest of them all. At one point on this river, between Celilo and the Dalles, it is estimated that 30,000 electric horsepower continuous can be developed and generated at a cost of $7.00 per horsepower-year, and an additional 236,000 horsepower for eight months of the year. These estimates are by John H. Lewis, state engineer of Oregon, and he makes the further statement that "an additional one million horsepower can be developed at this site, at a cost of $44.00 per horsepower and furnished at cost of $4.50 per horsepower-year," thus making a total of approximately one and one-half million horsepower for this one site. Assuming that one-half of this, or 750,000 horsepower, is available for Washington, letting the other one-half go to Oregon, and adding to this the various other amounts above mentioned, we have the amazing total of 2,455,000 horsepower available in the Puget Sound region. This total, while based for the greater part on comparatively rough government estimates, can be said to be a very conservative estimate. Such government estimates as can be compared with more detailed investigations of private engineers are thereby shown to be usually very much too small. Furthermore, these figures represent continuous power throughout the year, and are therefore based on the minimum flow of the streams augmented by possible storage, and it is common practice to install machinery from 50 to 100 per cent in excess of the minimum amount of power available, because the average demand for power is not often more than half the maximum. And when it is remembered that the period of maximum demand usually nearly coincides with the period of maximum flow, and that the time of maximum flow of the different streams in this region varies to a considerable extent, the possibilities of the situation are still further increased.

Then, there is the further possibility of operating a number of plants conjunctively in such a manner as to use those plants where the storage possibilities are large, to augment during the low-flow period those where storage possibilities are small, but the flow is large during the greater part of the year, and in this way enable them to overcome each other's deficiencies. For instance, Robert Howes, in his report on the White River project, commonly known as the Hebb site, shows that while in the extremely dry year of 1911 the average regulated flow with possible storage would have produced 34,250 electric horsepower continuous, for all except about 100 days of that year it would have produced nearly twice that amount, and that by providing 32.5 per cent from some other source for the 100 days, this plant could be run at twice its actual continuous capacity throughout the driest year on record. But during the average year and all years above the average, it could be run at double its 1911 continuous capacity for the entire year from its own supply of water, and for nine months of these years at a still greater capacity.

Commenting on this feature of the above power site, A. H. Dimock, city engineer of Seattle, in his report to the mayor remarks as follows: "For nine months of the year, and sometimes nearly the entire year, the White River has a flow exceeding 1,000 second-feet. If additional storage could be provided either on the White River or elsewhere, a still further installation would be desirable. The Cedar River power site will provide a storage of 180 square-mile-feet or nearly four times the storage which now seems possible in the White River. By installing two additional water wheels, bringing the total up to 120,000 horsepower, the large flow of the winter, spring and early summer months of the White River could be utilized for running the plant to its full capacity, while preserving the large storage in the Cedar River for use during the late summer and early fall. If, in addition, still further storage could be obtained, the possibilities of the White River proposition would be still further enhanced. Such a storage system may be obtained at Lake Cushman, the amount of water available by storage at this site being about 350 square-mile-foot, which is equivalent to 315 second-foot for the entire year. The available head at this site is also about 600 feet. The possibilities opened up by the operation of these three plants in connection with each other are very tempting."

Of course there is the element of cost to be considered, and a very important element it is. In the absence of detailed knowledge of any or all sites included in this estimate, no accurate cost data can be computed. But a comparison of a few of the most important developments here and in other parts of the United States, particularly the eastern part, will show that this is the region of cheap power, by comparison at least.

The Mississippi River Power Company has constructed a plant at Keokuk, Iowa, with an ultimate rated capacity of 240,000 electric horsepower. The installation cost, computed from the rated capacity and the estimated cost of the plant is $104 per horsepower. This company has contracted to supply 60,000 horsepower to a public-utility company in St. Louis, 140 miles away, at $18.00 per horsepower-year at a 60 per cent load-factor. The cost of 140 miles of transmission line at $3,000 a mile brings the total installation cost of this portion of the system to $116 per horsepower, exclusive of substations.

A project is now being financed in Eastern Canada which proposes to generate one million horsepower from the great St. Lawrence Rapids, about 25 miles from Montreal. The estimated cost of this plant, exclusive of transmission lines and substations, is $100 per horsepower.

The Dix River Power Company is building a 24,000-horsepower hydroelectric plant on the Dix River near its confluence with the Kentucky River. The total cost of this plant with transmission lines to Louisville and Lexington, Ky., Cincinnati, O., and some smaller cities enroute is estimated at $3,000,000, or $125 per horsepower.

In contrast to the above there may be cited the proposed plant of the Pacific Power & Light Company at Priest Rapids on the Columbia River, with an estimated ultimate capacity of one million horsepower, same as the St. Lawrence River plant, but costing, instead of $100,000,000, from 6 to 10 million, including a transmission system for supplying energy to the eastern part of Washington.

The Tacoma municipal plant installation cost, including transmission lines and substation, is $83 per horsepower.

The Seattle municipal plant, including duplicate transmission lines and city substation, cost $86.71; exclusive of transmission lines and substation, $52.91, on the basis of continuous capacity.

These figures, when compared with the $116 of the Mississippi River Power Company's plant, the $100 of the St. Lawrence River plant, and the $125 of the Dix River plant, make a showing

that is gratifying, to say the least, and we must not forget the proposed Columbia River plant, where, as stated above, it is estimated 1,500,000 horsepower can be developed at an installation cost of $44 per horsepower.

It is generally held among engineers, and it is susceptible of demonstration, that with a favorable load-factor such as is obtained from a large and diversified custom, power can be sold per horsepower-year at a reasonable profit at from 12 to 15 per cent of the installation cost per horsepower.

Summing up, then, it may be confidently stated that the development in the Puget Sound region, at a cost enabling its sale at a price that may be afforded by any industry now known, of an amount of power sufficient to supply a connected load of 3 million horsepower is well within the range of possibilities.

To generate this amount of power from steam would require the annual consumption of coal valued at $100,000,000, figuring 17 tons of coal per horsepower-year and coal at $2.00 per ton.

This amount of power is 90 per cent of the total power consumed by all the industries except transportation in the states of New York and Pennsylvania, the two largest power-consuming states in the United States, and is more than twice the amount consumed in all the industries except transportation in the cities of New York, Chicago, Philadelphia, Pittsburgh, St. Louis and Cleveland. In other words, with this amount of power we could, if they were located on Puget Sound, supply all the industries of these five cities and have enough power left to light the cities and run their street cars. The present development on Puget Sound is approximately 100,000 electric horsepower maximum capacity, or about three per cent of the total amount available.

Assuming that the possibility and feasibility of generating this enormous amount of power has been established, we are confronted with the problem of its profitable employment or use, for it is quite obvious that, whatever the amount, it is of no economic value unless put to a profitable use, and this is really the most difficult problem. Profitable use, however, is not necessarily a direct dividend-paying use. I am treating the situation from the standpoint of the greatest good to the greatest number. The answer to this problem is *Industrial Development.*

Cheap power is the chief factor of success in numerous industries which I will include in the broad general terms of the manufacturing industry, iron and steel-refining industry, and the electrochemical industry.

When it is remembered that iron ore can be obtained from China and California as cheap or cheaper than it can be had at Pittsburgh, that copper, tin and lead exist in large quantities in Alaska, British Columbia and some in Washington, it can be safely said that with the transportation facilities now existing, those to be added by the opening of the Panama Canal and the electrification of the mountain divisions of the railroads, the only other requisite to place the Puget Sound region in a position at least equal if not superior to that of the Atlantic Coast in the matter of manufacturing and industrial development is cheap power.

It is in the electrochemical industries, probably, that this region will witness the most rapid advance and the greatest increase in power consumption. Most of the electrochemical industries are comparatively new, but these have made such rapid progress that in European countries, particularly Norway, which is also a cheap power region, they take first rank among all the industries in value of products.

One of the oldest of these is the cement industry. A barrel of cement in the finished product represents an expenditure of 24 horsepower-hours. The state of Washington is known to possess the purest and most extensive deposits of limestone and clay suitable for the manufacturing of cement found anywhere on the Pacific Coast, and it is stated by men who are in a position to know, that if power were available, this industry would at once mount to one of the greatest importance. The amount of Portland cement manufactured in the United States in 1912 is estimated at 81,943,000 barrels, showing an increase over 1911 of 43 per cent. The curve of the production of Portland cement, in the face of a prolonged general stagnation of all trades and industries, is still rising and has yet to show its first downward course. The development of the cement products or concrete industry is one of the marvels of the last decade. The next decade will witness extensive road-building operations in Washington, and every mile of good road will require from 2,500 to 3,000 barrels of cement. There is every reason why every barrel of this cement and all other cement used in the State of Washington should be manufactured within the state, and then some.

The chemical engineer has done much for the benefit of his fellow man and his profession, though young, is rapidly becoming one of first rank. Nowhere is the value of his work more forcibly shown than in the development of the nitrate industry. Within the last four or five years, this industry has been developed by Samuel Eyde, in Norway, from one of merely experimental proportion to one requiring upwards of 250,000 horsepower continuously and employing 1,500 men. This industry has numerous branches, the most important being the manufacture of fertilizer. Part of the product is worked up into nitric acid which is used in the manufacture of dynamite, gun-cotton and smokeless powder.

The main portion, however, is worked up with limestone to form nitrate of lime. This nitrate is an exceedingly effective fertilizer. Large quantities have been imported into California and Hawaii for use in orchards and sugar plantations.

Another industry requiring a large amount of power is the manufacture of ammonia from the nitrogen of the air and pure hydrogen. An ammonia plant in Norway of 40,000 tons annual capacity requires 25,000 horsepower continuously.

Other chemical industries requiring large amounts of electric power are the manufacture of alloys, oxygen, hydrogen, carbide, graphite and gypsum products and the electrical distillation of wood. For all of these industries, this state possesses the required raw materials in unlimited quantities, and all require large quantities of electric power with daily and yearly load-factors of from 95 to 100 per cent.

Students Design Power Station.

In order to give students in the senior class of the College of Mechanical and Electrical Engineering of Kentucky University at Lexington an opportunity to do more practical work than is usually assigned, arrangements have been made by the university to have the class design a power plant at Hazard, Ky., in the heart of the Eastern Kentucky coal fields. The plant as designed will be intended to serve coal mines all over that general section, and though it is merely a theoretical proposition, it is hoped to interest capitalists in the matter of carrying out the plans. The students have made trips to Hazard and gone over the ground so as to make their plans with exact reference to the physical conditions. A number of manufacturers of electrical equipment, including the General Electric Company, are co-operating with the students and assisting them in their work.

It is now estimated that there is invested in the various electrical plants of all kinds in Japan about $280,000,000. Ten years ago this investment was only about $14,000,000. Thus this Japanese industry has increased twenty fold in a decade.

Industrial Research in America.

In his presidential address before the American Chemical Society at Rochester, N. Y., September 9, 1913, Arthur D. Little, speaking on the subject of "Industrial Research in America," said among other things:

Germany has long been recognized as pre-eminently the country of organized research. The spirit of research is there immanent throughout the entire social structure.

The virility and range of German research were never greater than they are today. Never before have the superb energy and calculated audacity of German technical directors and German financiers transformed so quickly and so surely the triumphs of the laboratory into industrial conquests. Never has the future held richer promise of orderly and sustained progress, and yet the pre-eminence of Germany in industrial research is by no means indefinitely assured. A new competitor is even now girding up his loins and training for the race, and that competitor is strangely enough the United States,—that prodigal among nations, still justly stigmatized as the most wasteful, careless, and improvident of them all.

To one at all familiar with the disdain of scientific teaching which has characterized our industry, and which still persists in many quarters, this statement is so contrary to the current estimate that its general acceptance cannot be expected. It will have served its purpose if it leads to a consideration of the facts which prove the thesis.

The country of Franklin, Morse, and Rumford, of McCormick, Howe, and Whitney, of Edison, Thomson, Westinghouse, and Bell, and of Wilbur and Orville Wright, is obviously a country not wholly hostile to industrial research or unable to apply it to good purpose. It is, however, not surprising that with vast areas of virgin soil, of which a share might be had for the asking, with interminable stretches of stately forest, with coal and oil and gas, the ores of metals, and countless other gifts of nature scattered broadcast by her lavish hand, our people entered upon this rich inheritance with the spirit of the spendthrift, and gave little heed to refinements in methods of production and less to minimizing waste. That day and generation are gone. Today their children, partly through better recognition of potential values, but mainly by the pressure of a greatly increased population and the stress of competition between themselves and in the markets of the world, are rapidly acquiring the knowledge that efficiency of production is a sounder basis for prosperity than mere volume of product, however great.

The long continued and highly organized research which resulted in the development of American agricultural machinery has led to the general introduction of machines which reduce the labor cost of seven crops $681,000,000, as measured by the methods of only fifty years ago.

The superhuman dexterity and precision of American shoe machinery, which has revolutionized a basic industry and reduced competition to the status of an academic question, present American industrial research at its best.

You need not to be reminded that the ubiquitous telephone is wholly a product of American research. New York has 450,000 instruments—twice the number of those in London. Los Angeles has a telephone to every four inhabitants. Our whole social structure has been reorganized. We have been brought together in a single parlor for conversation and to conduct affairs, because the American Telephone & Telegraph Company spends annually for research, the results of which are all about us, a sum greater than the total income of many universities.

The name of Edison is a household word in every language. The Edison method is a synonym for specialized, intense research which knows no rest until everything has been tried. Because of that method and the unique genius which directs its application, Italian operas are heard amid Alaskan snows and in the depths of African forests: every phase of life and movement of interest throughout the world is caught, registered, transported, and reproduced, that we may have lion hunts in our drawing-rooms and the coronation in a five-cent theater. From his laboratory have come the incandescent lamp, multiplex telegraphy, new methods of treating ores, and a thousand other diverse inventions, the development of a single one of which has sometimes involved millions.

To no chapter in the history of industrial research can Americans turn with greater pride than to the one which contains the epic of the electrochemical development at Niagara Falls. It starts with the wonderful story of aluminum. Discovered in Germany in 1828 by Wöhler, it cost in 1855 $90 a pound. In 1886 it had fallen to $12. The American Castner process brought the price in 1889 to $4. Even at this figure, it was obviously still a metal of luxury with few industrial applications. Simultaneously Hall in America and Heroult in Europe discovered that cryolite, a double fluoride of sodium and aluminum, fused readily at a moderate temperature, and, when so fused, dissolved alumina as boiling water dissolves sugar or salt, and to the extent of more than 25 per cent. By electrolyzing the fused solution, aluminum is obtained.

On August 26, 1895, the Niagara works of the Pittsburgh Reduction Company started at Niagara Falls the manufacture of aluminum under the Hall patents. In 1911 the market price of the metal was 22 cents, and the total annual production 40,000,000 pounds.

A chance remark of Dr. George F. Kunz in 1880 on the industrial value of abrasives turned the thoughts of Acheson to the problem of their artificial production, and led to the discovery in 1891 of carborundum and its subsequent manufacture on a small scale at Monongahela City, Pa. In 1894 Acheson laid before his directors a scheme for moving to Niagara Falls. To quote his own words:

"To build a plant for one thousand horsepower, in view of the fact that we were selling only one-half of the output from a 134-horsepower plant, was a trifle too much for my conservative directors, and they one and all resigned. Fortunately, I was in control of the destiny of the Carborundum Company. I organized a new board, proceeded with my plans, and in the year 1904, the thirteenth from the date of the discovery, had a plant equipped with 5,000 electrical horsepower, and produced over 7,000,000 pounds of those specks I had picked off the end of the electric light carbon in the spring of 1891."

The commercial development of carborundum had not proceeded far before Acheson brought out his process for the electric-furnace production of artificial graphite and another great Niagara industry was founded. In quick succession came the Wilson process for calcium carbide and the industrial applications of acetylene, phosphorus, ferroalloys made in the electric furnace, metallic sodium, chlorine and caustic soda first by the Castner process, later by the extraordinarily efficient Townsend cell, electrolytic chlorates and alundum.

Perhaps even more significant than any of these great industrial successes was the Lovejoy & Bradley plant for the fixation of atmospheric nitrogen, which was perforce abandoned. It is well to recall, in view of that reputed failure, that the present-day processes for fixing nitrogen have made little, if any, improvement in yields of fixed nitrogen per kilowatt-hour over those obtained in this pioneer Niagara plant.

In Acheson and Hall have already been named two recipients of the Perkins medal, the badge of knighthood in American industrial research. The distinguished and thoroughly representative juries which award the medal annually had previously bestowed it upon Herreshoff for his work in electrolytic copper refining, the contact process for sulphuric acid, and the invention of his well known roasting furnace, and upon Behr for creative industrial research in the great glucose industry. In 1912 it was received by Frasch, and this year was awarded Gayley.

Chemistry in America is essentially republican and pragmatic. Most of us believe that the doctrine science for science's sake is meaningless and mischievous as that of art for art's sake or literature for literature's sake. These things were made for man, not for themselves, nor was man made for them. Most of us are beginning to realize that the major problems of applied chemistry are incomparably harder of solution than the problems of pure chemistry, and the attack, moreover, must often be carried to conclusion at close quarters under the stress and strain induced by time and money factors. Under these circumstances it should not excite surprise that a constantly rising proportion of our best research is carried on in the laboratories of our great industrial corporations, and nowhere more effectively than in the research laboratory of the General Electric Company under the guidance of your past president, Dr. Whitney. As to the laboratory method, Dr. Whitney says in a personal letter: "We see a field where it seems as though experimental work ought to put us ahead. We believe that we need to get into the water to learn to swim, so we go in. We start back at the academic end as far as possible, and count on knowing what to do with what we find when we find it. Suppose that we surmise that, in general, combustible insulation material could be improved upon. We try to get some work started on an artificial mica. Maybe we try to synthesize it, and soon come to a purely theoretical question, for example: Is it possible to crystallize such stuff under pressure in equilibrium with water vapor corresponding to the composition of real mica? This may lead a long way and call in a lot of pure chemistry and physical chemistry. Uusually we just keep at it, so that, if you haven't seen it on the market, we're probably at it yet."

In striking contrast to the secrecy maintained between individual workers in large German research laboratories is the almost universal custom in America to encourage staff discussion. In the General Electric laboratory, as in many others, the weekly seminars and constant helpful interchange of information have developed a staff unity and spirit which greatly increases the efficiency of the organization, and raises that of the individual to a higher power.

Many evenings could profitably be spent in discussing the achievements of this laboratory. Their quality is well indicated by the new nitrogen tungsten lamp, with its half-watt per candle, which combines the great work of Dr. Coolidge on ductile tungsten with the studies of Langmuir and others of the staff on the particular glass and gas and metal which are brought together in this lamp.

Any attempt to adequately present the enormous volume of research work, much of which is of the highest grade, constantly in progress in the many scientific bureaus and special laboratories of the general Government or even to indicate its actual extent and range, is of course utterly beyond the limits of my attainments or of your patience. The generous policy of the Government toward research is unique in this, that the results are immediately made available to the whole people.

In the United States Patent Office Dr. Hall has developed a remarkably comprehensive index to chemical literature, which now contains 1,250,000 cards and which is open to every worker. The Bureau of Fisheries devotes $40,000 to a single study, and the Geological Survey $100,000 to the investigation of the mineral resources of Alaska. It spent in 1913 $175,000 for engraving and printing alone.

The superb Geophysical Laboratory of the Carnegie Institution of Washington is also constantly engaged in the most refined researches into the composition, properties, and mode of genesis of the earth's crust. The Smithsonian Institution is honored throughout the world for the efficiency of its effort to increase and diffuse useful knowledge among men.

Perhaps no better evidence could be adduced of the present range and volume of industrial research in America than the necessity, imposed upon the author, of such a general survey as I am attempting, of condensing within a paragraph his reference to the Bureau of Standards of the Department of Commerce. Its purpose is the investigation and testing of standards and measuring instruments and the determination of physical constants and the properties of materials. To these objects it devotes about $700,000 a year to such good effect that in equipment and in the high quality and output of its work it has in ten years taken rank with the foremost scientific institutions in the world for the promotion of industrial research and the development and standardization of the instruments, materials, and methods therein employed. Its influence upon American research and industry is already profound and rapidly extending. The Bureau coöperates with foreign governments and institutions, and is constantly consulted by state and municipal officials, technical bodies, commissions and industrial laboratories, as a court of highest appeal.

In view of the evidence offered by Germany of the far-reaching benefits resulting from the close coöperation which there obtains between the university laboratory and the industrial plant, it must be admitted with regret that our own insitutions of learning have, speaking generally, failed to seize or realize the great opportunity confronting them. They have, almost universally, neglected to provide adequate equipment for industrial research, and—which is more to be deplored, since the first would otherwise quickly follow—have rarely acquired that close touch with industry essential for familiarity and appreciation of its immediate and pressing needs. There are happily some notable exceptions. Perhaps foremost among them stands the Massachusetts Institute of Technology with its superb engineering and testing equipment, its Research Laboratory of Applied Chemistry, and the meritorious thesis work of its students in all departments. The Biological Department has been especially active and successful in extending its influence into industrial and sanitary fields, while unusual significance attaches to the motor-vehicle studies just concluded and the more recently inaugurated special investigations in electricity, since both were initiated and supported by external interests.

Several of the great universities of the Middle West, notably Wisconsin and Illinois, have placed themselves closely in touch with the industrial and other needs of the community, and are exerting a fundamental and growing influence upon affairs. In the East, Columbia has recently established a particularly well equipped laboratory for industrial chemistry, and is broadening its work in this department.

The Universities of Kansas and of Pittsburgh are carrying forward an especially interesting experiment in the operation of industrial research fellowships, supported by the special interests directly concerned.

Reference has already been made to the highly organized, munificently equipped, and splendidly manned laboratories of the Du Pont Company, the General Electric Company, and the Eastman Kodak Company. There are in the country at least fifty other notable laboratories engaged in industrial research in special industries. The expenditure of several of them is over $300,000 each a year. The United States Steel Corporation has not hesitated to spend that amount upon a single research, and the expenses of a dozen or more laboratories probably exceed $100,000 annually. One of the finest iron research laboratories in the world is that of the American Rolling Mills Company. Equally deserving mention from one aspect or another are the laboratories of the Fire Underwriters, the National Carbon Company, the Solvay Process Company, the General Bakelite Company, Parke, Davis & Company, the Berlin Mills Company, the United Gas Improvement Company, the National Electric Lamp Association, Swift & Company, the Pennsylvania Railroad, and many others.

The steel industry in its many ramifications promotes an immense amount of research, ranging from the most refined studies in metallography to experimentation upon the gigantic scale required for

the development of the Gayley dry blast, the Whiting process for slag cement, or the South Chicago electric furnace. This furnace has probably operated upon a greater variety of products than any other electric furnace in the world. Regarding the steel for rails produced therein, it is gratifying to note that after two and one-half years or more no reports of breakage have been received from the 5,600 tons of standard rails made from its output. The significance of this statement will be better appreciated when we consider that in 1885 the average total weight on drivers was 69,000 pounds. It had risen to over 180,000 pounds in 1907, and reached a maximum of 316,000 pounds in that year. The weight of rails during the same period had increased from 65-75 pounds to 85-100 pounds. In 1905 conditions were so bad that out of a lot of 10,000 tons 22 per cent was removed the first year because of depressions in the head. In 1900 the American Railway Engineering Association took the matter in hand, and studied the influence of segregation of specific impurities.

There could well be a further great enlargement of the field of industrial research in special industries through the initiative and support of national trade associations, to the great benefit of their membership. The American Paper and Pulp Association, for example, should subsidize studies in the utilization of waste sulphite liquors, the paper-making qualities of unused woods and fibers, the hydration of cellulose, new methods of beating, the yields from rags, the proper use of alum, and so on. The American Institute of Metals could not do better than initiate investigations into zinc losses, the physical properties of alloys, and the production of alloys to specifications defining the properties desired, the application of the electric furnace to the industry, and the preparation of new alloys by electric or other methods. A similar opportunity knocks at the door of the American Foundrymen's Association. Some few associations, like those of the bakers and the laundrymen, are already active to good purpose; others, like the Yellow Pine Lumber Manufacturers' Association, are aroused; but, to the great majority of those powerful organizations, research is still an academic question to be discussed by their members individually if they so choose. Every industry has, however, its broad research problems, and its points especially vulnerable to research attack, among which it should be easy to select those of general interest to the industry as a whole.

Industrial research is applied idealism. It expects rebuffs, it learns from every stumble, and turns the stumbling-block into a stepping-stone. It knows that it must pay its way. It contends that theory springs from practice. It trusts the scientific imagination, knowing it to be simply logic in flight. It believes with F. P. Fish, that "during the next generation—the next two generations—there is going to be a development in chemistry which will far surpass in its importance and value to the human race that of electricity in the last few years,—a development which is going to revolutionize methods of manufacture, and more than that, is going to revolutionize methods of agriculture;" and it believes with Sir William Ramsay that "the country which is in advance in chemistry will also be foremost in wealth and general prosperity."

With these articles of faith established in our thought, let us consider where they lead us. Within the last few days Frank A. Vanderlip, than whom no one speaks with more authority upon financial matters, has told the assembled representatives of the electrical industries that they are facing a capital requirement of $8,000,000 a week for the next five years,—a total within that period of $2,000,000,000. As chemists, we are ourselves entering upon an era in which the capital demands of industries now embryonic or not yet conceived will in the not distant future be equally insistent and even more insatiable. Have we as chemists given a thought to this aspect of the development of our science or planted the seeds of the organization which may some day cope with it? In the electrical and other established engineering professions it is significant that the great industrial applications of the sciences involved have been in large part due to the activities of firms and organizations like Stone & Webster, J. G. White & Company, Blackwell, Viehle & Buck, and the United Gas Improvement Company, which by an orderly but inexorable evolution passed from the status of engineers to that of engineers and bankers. Our own profession has not yet evolved the chemist and banker, but such an evolution, or at least the close alliance of chemistry and banking, is a fundamental prerequisite if the results of industrial research are to find their full fruition in America. Let me add that no field within the purview of the banker is more ripe for tillage or capable of yielding a richer harvest.

We need a multiplication of research laboratories in special industries, each with an adequate staff of the best men obtainable and an equipment which gives full range to their abilities. In nearly every case this equipment should include apparatus of semicommercial size in which to reduce to practice the laboratory findings. Nothing is more demoralizing to an industrial organization, and few things are more expensive, than full-scale experimentation in the plant.

These laboratories should each be developed around a special library, the business of which should be to collect, compile, and classify in a way to make instantly available every scrap of information bearing upon the materials, methods, products, and requirements of the industry concerned. Modern progress can no longer depend upon accidental discoveries. Each advance in industrial science must be studied, organized, and fought like a military campaign.

Pennsylvania Electrification.

In announcing that it will establish schools of electrical instruction for its employees at Conemaugh, Derry, Gallitzin, Cresson, Pitcairn and Pittsburgh, Pa., the Pennsylvania Railroad has given rise to the report that the intention is to electrify the Pittsburgh division, which extends from Pittsburgh to Altoona, a distance of 119 miles. In this stretch is the big mountain range at the summit of which is the Gallitzin tunnel, and at the eastern end of the tunnel begins the big descent that is known as the famed "Horseshoe Curve." This 119 miles from Pittsburgh to Altoona is considered one of the most difficult problems in steam railroading in America. Should the Pennsylvania Railroad install electric power on this division it would be only a question of time until the entire system would be electrified.

The new schools are to be equipped with all the apparatus used in the electrical operation of trains and the various phases of the method will be explained in theory and practice. Among transportation men in Pittsburgh this move upon the part of the Pennsylvania is regarded as peculiarly significant. In some quarters it is looked upon as marking the first vital step in the movement that ultimately will bring about the complete electrification of the entire Pennsylvania system.

Pennsylvania Railroad officials, although reticent regarding the project, admit that plans for electrifying the Pittsburgh terminal are under consideration. Eight miles of the main line of the Pennsylvania, from the Union Station in Pittsburgh, to Braddock, Pa., are being elevated. This work will be completed about the time that the electrification of the Philadelphia terminal is completed. Then, it is said, the forces employed on that job will be transferred to Pittsburgh. More to the point is the fact that the new steel equipment used at Pittsburgh is being constructed with the car bodies sufficiently elevated above the trucks to permit the installation of motors on them later.

The Arkansas Hydro-Electric Company has been incorporated to construct a 10,000-horsepower development on the Little River, near Heber, Ark. The plans call for an expenditure of $2,000,000.

Annual Report of the Commissioner of Patents.

The annual report of the commissioner of patents covering the business of the United States Patent Offices for the calendar year 1913 has been made public by Commissioner of Patents Thomas Ewing.

There were received during the year 68,117 applications for patents on inventions, 2,060 applications for patents on designs and 190 applications for reissues of patents. There were issued 35,624 patents, including designs, and 164 patents were reissued, making a total of 35,788 patents; 30 patents were withdrawn. Of the net total of 35,594 patents, 31,382 patents were issued to citizens of this country and 4,212 patents were issued to citizens of foreign countries. During the year 21,867 patents expired. The total receipts of the Patent Office from all sources were $2,084,417.79 and the total expenditures were $1,947,388.28, leaving a surplus of $137,034.51 of income over outlay; the total accumulated surplus to the credit of the Patent Office in the United States Treasury at the close of business on December 31, 1913, was $7,297,052.46. There are on hand about 47,000,000 printed copies of patents, which are for sale at five cents each. Last year there were sold 2,340,867 copies of patents.

Commissioner Ewing makes many pertinent comments on the status of the Patent Office and its work and makes a number of recommendations for improvement. The crowded condition of the building, although repeatedly called to the attention of Congress, is steadily growing worse. New plans have been prepared for a practically fireproof two-story addition under the present level of the court. This will greatly relieve physical congestion.

The examining corps now is composed of 2 law examiners, 43 principal or primary examiners and 334 assistant examiners. This disproportion of the number in the lower grades to those in the higher grades slows down promotions and induces ambitious young men to leave the Patent Office after they have been admitted to the bar. It is urged by Commissioner Ewing that the examining force be reorganized in the following particulars: (1) by restoring the grades of first, second, third and fourth assistant examiners; and (2) by increasing the number in the higher grades and reducing the number in the lower grades, so as to make them equal. It is suggested that each of the four grades of assistant examiners comprise 86 men, thus making an increase of 10 assistant examiners over the present number. There should also be an increase of two members of the board of examiners-in-chief. At present the board consists of three members, two of whom constitute a quorum.

The valuable library of the Patent Office is in present need of reorganization and enlargement. The collection of books, periodicals, and foreign patents is of the utmost value to the examining corps, inventors, manufacturers and attorneys interested in investigating the novelty of inventions, but the material is not and never has been in condition for ready reference. Much of it is practically unavailable. There has been started the work of reclassifying and indexing, with a view to meeting more nearly the peculiar needs of those who use the library. This library of about 75,000 volumes of scientific works and about 2,000,000 foreign patents, used, as it is, by people who are doing work which is almost identical with that of the examining corps, requires a librarian of special training and ability.

It has been suggested that instead of publishing in the *Official Gazette* selected claims, as is now the practice, there should be published a brief digest of the patents. These digests would be valuable to the examining corps and aids in searching. It would be necessary, however, to employ a corps of digesters large enough and highly trained enough to digest intelligently more than a hundred patents a day. The expense of this work would be largely, if not entirely, saved by the decrease in the cost of printing, since the digests would not be as extensive as the claims now printed.

A serious problem is to bring the work of the Patent Office up to date, so that there shall be no unreasonable delay in passing upon an application after it has been filed. At present there are awaiting action as many new applications as are filed in two months and as many old applications as are amended in one month. An examination has been made to ascertain the number of applications filed as much as 15 years ago; 79 such applications have been reported as pending. Commissioner Ewing has issued an order that all cases which have been pending before the Patent Office for more than eight years shall be made special, and to the end that there may be a uniform ruling applied to all such cases he has directed that no amendment filed in any such application after June 1 of this year shall be entered without his approval. Thereby he hopes to make it impossible for an applicant to prosecute his application by dilatory or time-consuming amendments, by refusing to enter amendments which are not proper responses to Office actions and in appropriate cases holding the applications to be abandoned. Mr. Ewing is also considering the propriety and wisdom of making these old applications public. The statute contains no provision against it. There is, however, a rule of the Office, under which they have all been filed, which declares that the applications shall be preserved in secrecy. Mr. Ewing believes that with proper administration it is possible to limit the time during which an application may be kept pending in the Office to less than five years, and perhaps to less than three years, without unduly reducing the applicant's right to consideration of his case. Few applicants who deliberately keep their cases in the Office for many years are entitled to favorable consideration. On an average, applications are in the Office about two years, and in the vast majority of cases this length of time is sufficient for thorough consideration of the applicant's claims.

Commissioner Ewing urges the need of more energetic work in reclassifying and indexing the vast number of American and foreign patents. This work was started several years ago but needs a larger force to push it more promptly. A revision is needed of the fees for recording assignments and an index of assignees should be established. Clerks of federal courts should be required to file a copy of all patent decrees with the Patent Office. The protection of designs should be put on a registration basis. Mr. Ewing points out a number of objections to the act which has been passed by Congress for the protection of exhibitors at the Panama-Pacific International Exposition next year; he believes that this act should be modified by limiting it to designs and articles embodying designs or patents protected abroad and by adding the provision against suits for infringement based upon exhibits.

Congress Expected to Appropriate $100,000 to Investigate Valuation of Washington, D. C., Utilities.

For the work of making a physical valuation of the telephone properties, gas and electric-light plants and street-car lines in the District of Columbia Congress is expected to immediately appropriate the sum of $100,000.

According to District of Columbia Commissioner Harding, who explained to Congress last week the necessity of money for valuation of public utilities, the first survey to be undertaken will include the properties of the Chesapeake & Potomac Telephone Company, the Washington Railway & Electric Company, the Potomac Electric Light & Power Company, and the Capital Traction Company.

New Electrical and Mechanical Appliances

Cable and Loom Clamps for Steel Wall Boxes.

The increasing use of flexible armored cables has called attention to the rather troublesome manner in which this type of conductor is usually fastened to outlet boxes. To meet this difficulty the Machen & Mayer Electrical

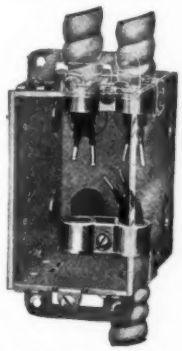


Fig. 1—Wall Box Fitted with Clamps for Armored Cable.

Manufacturing Company, Philadelphia, Pa., has added a valuable feature to its Unisectional steel wall boxes, which were described in a recent issue of this journal. As shown in Fig. 1, one of these clamps is prepared particularly

Fig. 2—Box with Clamps for Loom.

for use with flexible armored cable. It has the distinction of combining in one simple device both a cable clamp and a bushing. This clamp effectively holds all makes of armored cable securely to the box. At the same time the ring or bushing, which forms part of the clamp, protects the insulation from injury and abrasion. The clamp is heavily brass-plated to insure making a good electrical contact and also to protect it from corrosion. The Unisectional wall boxes are furnished complete with clamps at slightly additional cost. These clamps will take one or two cables as needed. Since all of the material is combined in one fitting the trouble from shortage of parts on the job is obviated. By giving the clamp binding screw a few turns the cable is permanently held in place.

A similar type of clamp designed for use with circular loom or similar flexible armoring is shown in Fig. 2. This type of clamp has proven a very convenient and effective means of fastening the loom in switch boxes, saves the trouble of using tape for this purpose and makes a more secure job.

The Cochran Automatic Nut Wrench.

A very convenient nut wrench has been placed on the market by the Cochran Pipe Wrench Manufacturing Company, 7800 Woodlawn Avenue, Chicago. This wrench, on account of the speed with which it can be operated for various sizes of nuts from one-quarter to three-quarter inch has appropriately been called the "Speednut" wrench. As shown in the illustration, the movable jaw is attached to a short rack. This engages a few teeth on the swiveled end of the handle. By placing the movable jaw against the near side of the nut and pulling on the handle it is evident that a very tight grip is obtained on the nut without preliminary adjustment; thus the ordinary thumb screw adjustment of a monkey wrench is eliminated. The harder one pulls the tighter does the wrench grip the nut; this prevents slipping and wearing off the edges of the nut. The wrench is very compact and light in weight. Its construction is simple, since it contains but three pieces. Thus it has no complicated parts to get out of order and is always ready for immediate use. A patent on this wrench has been applied for.

Automatic Nut Wrench.

Small Transformer for Bell Ringing and Miniature Lamps.

The A. E. Rittenhouse Company, Honeoye Falls, N. Y., has recently placed on the market something new in the way of a bell-ringing transformer, which can also be used to light small six-volt lamps. The unique feature of this transformer is that it is made to fit the standard single-gang switch box. The plate which covers the opening is black-enameled and is drilled and tapped so that any standard iron-box bell may be mounted thereon. This not only makes a very neat job, but almost eliminates line troubles as the only secondary wiring necessary is the

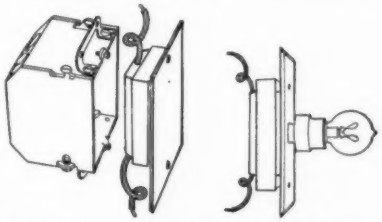


Fig. 1—Transformer Fitting Switch Box. Fig. 2—Used with Special Plate and Miniature Lamp.

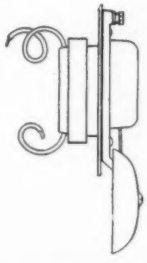


Fig. 3—Bell Mounted on Transformer Plate.

push-button loop. The transformer plate is also tapped to take a standard switch plate and one of the accompanying illustrations shows the transformer used in conjunction with a type "O" Perkins switch plate and two-candlepower six-volt lamp. This makes a good outfit for a night light, as the power consumption is less than three watts, including transformer loss. The transformer may also be used for surface mounting.

The Schweitzer Cable-Fault and High-Voltage Detector.

When a primary or high-voltage main forming part of a "tree" system of mains connecting to the feeder becomes defective, the oil switch, high-potential fuse, or similar disconnecting device in the station operates. The entire circuit is then dead, and it is necessary to disconnect all of the branches which can be disconnected, and these must be reconnected, one branch at a time, commencing with the branch or main or feeder nearest the station.

As each constituent part is reconnected there is danger that the service on all the parts without fault will become affected since the branch last connected may prove to be the faulty one. To prevent the shutting down of the circuit when connecting additional branches, each additional branch must first be tested for faults. Hitherto a variety of makeshift devices have been used for testing additional branches before connecting. Chief among these has been the use of a bank of lamps connected in series for 2,300 volts or the use of a small transformer or fuses. Practical experience has clearly demonstrated that these makeshifts are entirely unsuited for this class of testing. For safety to the man and to the system they require that the lineman be an expert in this line of testing. Even then the testing is accompanied by considerable danger both to the man and to the system.

To meet the demand for a simple and reliable device that can be used with complete safety on overhead and underground cable and similar installations, the Schweitzer cable-fault and high-voltage detector has been designed. This detector consists of a simple combination of incandescent lamps and resistance rods, the terminals of which are connected directly across the line to be tested. The glowing of the lamps indicates the presence of potential. The rods and lamps are inclosed in a case of insulating material and provided with the necessary lead terminals, selector switch and carrying strap.

By means of this device a cable under test can be subjected to approximately the wave shape under which it must operate and a potential rise of about 100 per cent will occur, but with the energy flow limited, at the time that the cable is connected. This is the usual limit of potential rise when connecting an unloaded cable to the cable system and is a good test value to show whether or not the cable should be connected. The detector discriminates and tells whether charging current or fault current flows. This it does in a very simple fashion and it may be safely placed in the hands of an ordinary lineman. The directions for its use (see Fig. 2) are far simpler than those which are regularly given for ordinary classes of work done by linemen.

This device eliminates the need of two men carrying a heavy and easily puncturable transformer and lead connections from one overhead substation to another and of having one man climb the pole with the leads trailing about his legs. The Schweitzer detector is light and easily carried in the lineman's raincoat pocket. All exterior parts are made of insulating material. As its name implies this device can be used as either a high-voltage detector or as a cable-fault detector. It is made in two sizes, 600 to 6,600 volts and 6,600 to 13,200 volts.

The instrument described and illustrated above is known as the type A detector. Similar instruments as regards general design, but intended for use in central stations or substations, are also made by the designers and manufacturers of these devices, Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, Ill.

Fig. 1—High-Voltage Detector.

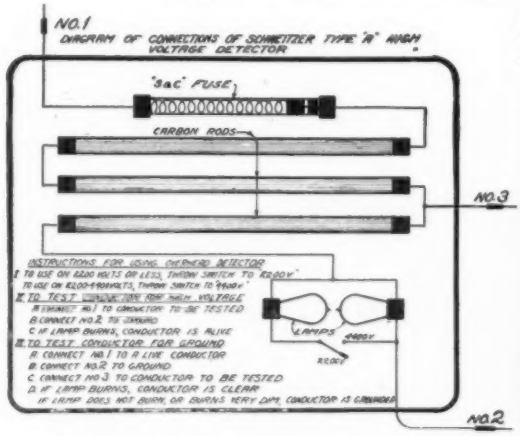

NO.1
DIAGRAM OF CONNECTIONS OF SCHWEITZER TYPE "A" HIGH VOLTAGE DETECTOR
"3AG" FUSE
CARBON RODS
NO.3
INSTRUCTIONS FOR USING OVERHEAD DETECTOR
I TO USE ON 2200 VOLTS OR LESS, THROW SWITCH TO "2200V."
TO USE ON 6600-13200 VOLTS, THROW SWITCH TO "13200V."
II TO TEST CONDUCTOR FOR HIGH VOLTAGE
A CONNECT NO.1 TO CONDUCTOR TO BE TESTED
B CONNECT NO.2 TO GROUND
C IF LAMP BURNS, CONDUCTOR IS ALIVE
III TO TEST CONDUCTOR FOR GROUND
A CONNECT NO.1 TO A LIVE CONDUCTOR
B CONNECT NO.2 TO GROUND
C CONNECT NO.3 TO CONDUCTOR TO BE TESTED
D IF LAMP BURNS, CONDUCTOR IS CLEAR
IF LAMP DOES NOT BURN OR BURNS VERY DIM, CONDUCTOR IS GROUNDED
LAMPS
2200V.
13200V.
NO.2

Fig. 2—Connections and Directions for Detector.

Short-Circuit Test of a Large Generator.

In the presence of a number of representatives of central stations, the engineers of the Westinghouse Electric & Manufacturing Company recently deliberately short-circuited a 16,700-kilovolt-ampere, 8,800-volt generator running at full speed and without resistance or any other protection in the circuit. Oscillogram records showed that a current of 21,000 amperes, or 12.5 times normal, flowed through the generator.

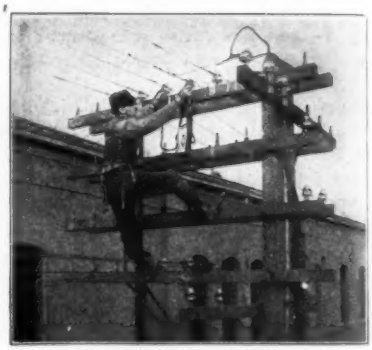


Fig. 3—Detector Used on Pole Line.

With generators designed some years ago such a test would have wrecked the machine, but in the present instance no damage whatsoever was done. The only visible effect was a static flash between the field and the armature.

The test was performed to prove the fact that generators are being built that require no outside protection from outside short-circuits, the generator itself being so designed as to be self-protecting. Unless the generator is properly constructed a complete short-circuit tears out the armature coils, which, coming into contact with the revolving field, causes extensive wreckage. Furthermore, the static flash, which always occurs under such circumstances, will destroy inferior insulation. With generators of the type tested, however, both results are guarded against by

firmly securing the armature coils and bracing their ends, on one hand, and by the use of mica insulation on the other. In consequence even so severe an ordeal as this test was withstood without harm, although it has been repeated many times with the same machine.

In connection with this test several others were carried out in order to prove the reliability of circuit-breakers and reactance coils for protecting the feeder circuits. The generator was repeatedly short-circuited through these devices which stood up admirably under the enormous stresses to which they were subjected.

The practice recommended by the Westinghouse engineers is to protect the feeders and not the generators. If the generators are protected and a short-circuit occurs on any of the feeders, even a poorly designed generator will not suffer, but the voltage will fail on all the feeders, all synchronous motors will be thrown out of step, and an overwhelming overload will be thrown on the circuit-breaker of the short-circuited feeder, since it will carry the total current of all the generators in the station. If, however, protective reactances are placed in each feeder circuit, and a short-circuit in a feed occurs, only that feeder will be affected and even then its reactance coil will prevent the current in it from rising to too high a value. The voltage will be maintained at the busbars and no disturbance will be felt in the remaining feeders. This happens, of course, provided that the generators are self-protective; if not, such an event may seriously injure them.

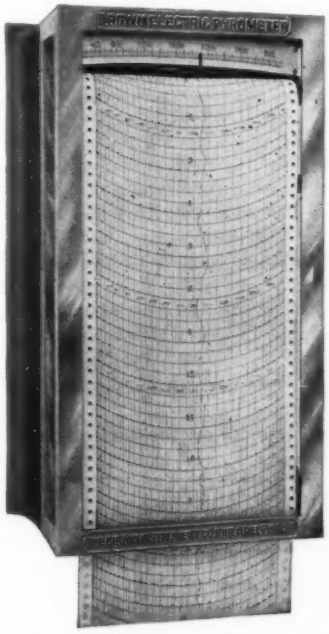


Fig. 1—Continuous-Chart Recording Instrument.

It is, of course, possible to protect non-self-protecting generators by reactances, but as the test described above shows, such a proceeding is unnecessary since generators can be supplied that are immune to the worst conditions of load that can be imposed upon them.

A New Continuous-Chart Recording Instrument.

The Brown Instrument Company and the Keystone Electrical Instrument Company, of Philadelphia, Pa., are placing on the market a new type of continuous recording instrument for use as an electrical pyrometer for recording temperature, and also as a recording voltmeter or ammeter. Great efforts have been made to produce an instrument as simple in construction as possible and of the most compact form. The case of the instrument is only 15 inches high by 8 inches wide, and projects from the switchboard or wall 7 inches. The space occupied by the instrument has been largely reduced by placing the clock mechanism behind the record chart instead of to one side, and the record chart is the only part shown on the face of the instrument.

A two-months' roll of record paper is used which can be supplied with an ink ribbon to make a dotted ink record, or the record can be made on coated paper, which does away with the use of ink or ribbon entirely. It is only necessary to wind the clock once a week and change the roll of record paper once every two months.

Fig. 1 shows the complete instrument with 10 hours' record on the recording chart. One scale is placed above the record so that the indications are clearly visible at all times, and the paper has the scale printed on it for direct reading. Fig. 2 shows the instrument with the door open and the interior construction can be clearly seen. This case need only be opened once every two months to renew the roll of paper.

This new continuous recording instrument will prove particularly advantageous for use as an electric pyrometer in conjunction with thermocouples, for resistance thermometers for measuring low temperatures, or for recording volts or amperes. As the D'Arsonval type of direct-current instrument used is of the frictionless type to prevent lag in the readings, a particularly sensitive and accurate instrument is secured by this arrangement.

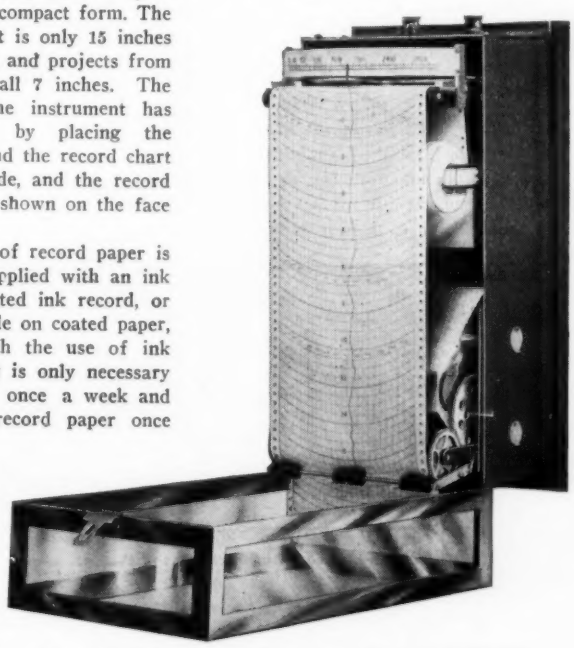


Fig. 2—Front Cover Opened to Show Interior Arrangement.

Brown-Boveri System of Phase Compensation for Improvement of Power-Factor With Induction Motors.

The Brown-Boveri method of phase compensation will prove of interest to power users in factories and elsewhere on account of the fact that it enables the size of motors to be reduced for a given power, or in other cases to obtain much more power out of existing motors, thus often making it unnecessary to increase the size of a factory plant. This apparatus is manufactured in France by the Compagnie Electro-Mécanique, of Paris.

The poor power-factor which is so often found in three-phase plants is chiefly due to the use of induction motors, and mainly to large-size motors running at low speed. However, even the high-speed motors can have an unfavorable effect if they run at light load or no load. To make the matter clear, it is known that all motors require to be excited. In the case of synchronous motors the exciting current is supplied by a source of direct current, while non-synchronous motors must take their exciting current from the three-phase mains themselves. The latter motors require two kinds of current, one for the work and the second for exciting or magnetizing. The magnetizing current is called wattless, as it does no work and lags 90 degrees behind the working current. In the well known victor diagram, the total current is shown to be the resultant of the two component currents,

and a certain phase angle or power-factor is produced thereby

The exciting current has a value which is nearly independent of the load, so that when the load (or work current) is lessened, the phase angle increases. At no load, the energy component reaches a minimum and the power-factor drops to 0.10 or 0.15 and the motor takes about 40 per cent of the full-load current. The less the motor is loaded, the less will be the power-factor. Practical tests show that in industrial plants having three-phase motors the power-factor is generally between 0.6 and 0.85, and this high limit is rarely exceeded. The exciting current for non-synchronous motors must be furnished by the central-station machines at the same time as the work current, so that a low power-factor for the motors, say 0.5, means the use of but half the current capacity of the station. It is found that the necessary exciting current can be supplied through the rotor of the induction motor jus. as well as through the stator.

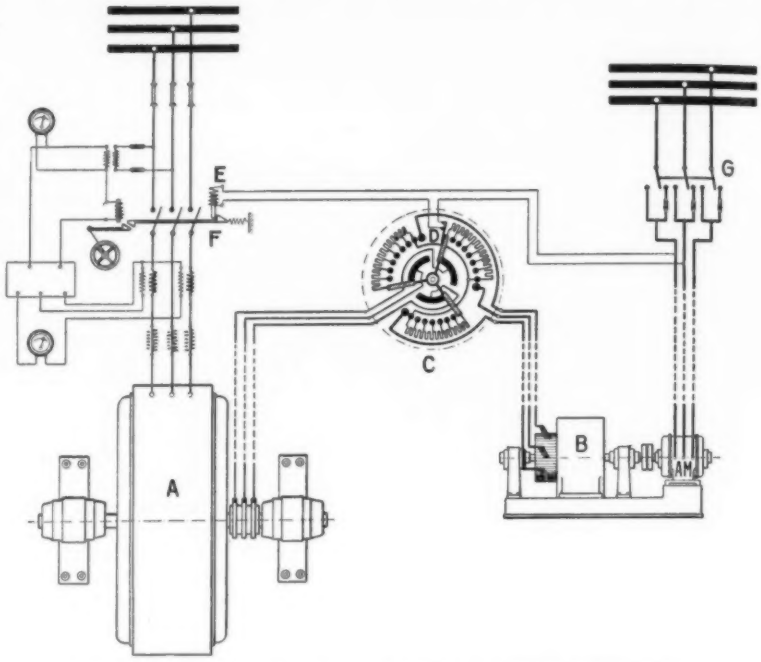


Fig. 2—Connections of Main Motor, Starter and Phase Compensator.

Methods of improving the power-factor of motors come under two classes. A single machine can produce the exciting current for all of the motors on the line, or each motor can have a separate compensating device. The first class comprises the over-excited synchronous motor, the synchronous motor-generator set and the rotary converter. All such machines can be overcompensated when they are sufficiently excited and when they are liberally enough designed in size, so that they send a magnetizing current to the line which compensates the lag therein. Should this be impracticable, a synchronous motor can be used which runs at no load and serves altogether for compensating the lag. But this solution means considerable cost of plant and upkeep and is not entirely satisfactory. Such machines in fact bring in their inherent defects, such as difficulty in starting up, danger of hunting and uncoupling. Besides, for a given excitation the synchronous machines produce a constant magnetizing current, but the same value of this current is not always required by the line.

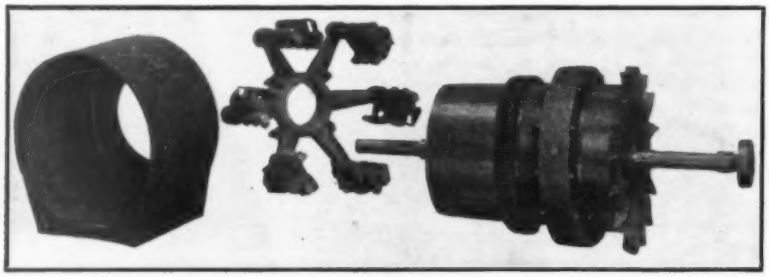


Fig. 1—Three Main Parts of the Phase Compensator.

The Brown-Boveri method belongs to the second class, that is an individual compensator for each motor. It requires that the plant possess one or several large motors which are constantly running. The new method is claimed to have none of the drawbacks of the first-mentioned one, and an induction motor thus equipped possesses in itself all the advantages of both synchronous and non-synchronous motors without the drawbacks of either. The phase compensator is a special machine (with commutator of polyphase type) which is coupled preferably to a small motor, or can be coupled to the principal motor. The rotor (see Fig. 1) has a drum winding and commutator, the bars of the winding being lodged in slots in the laminated core. If a polyphase current is sent through the brushes, for instance the current from the rotor of the main motor, the device in a stationary position acts as an induction coil and thus produces a reactance and a lag of the current. For a given current, this reactance depends on the frequency, i. e.,

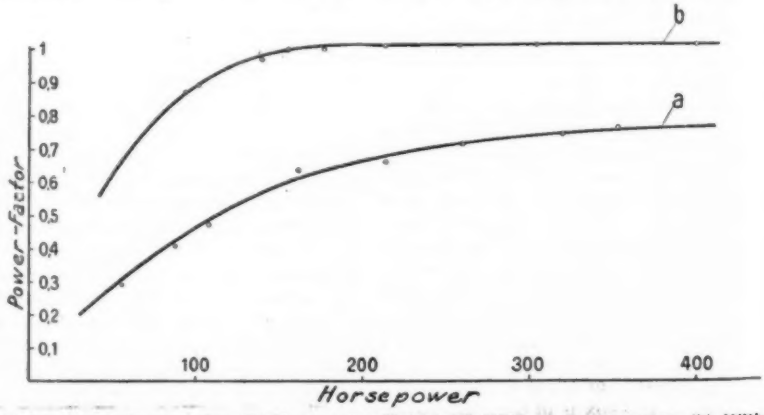


Fig. 3—Power-Factor of a 400-Horsepower Motor; (a) Without Compensator, (b) With Compensator.

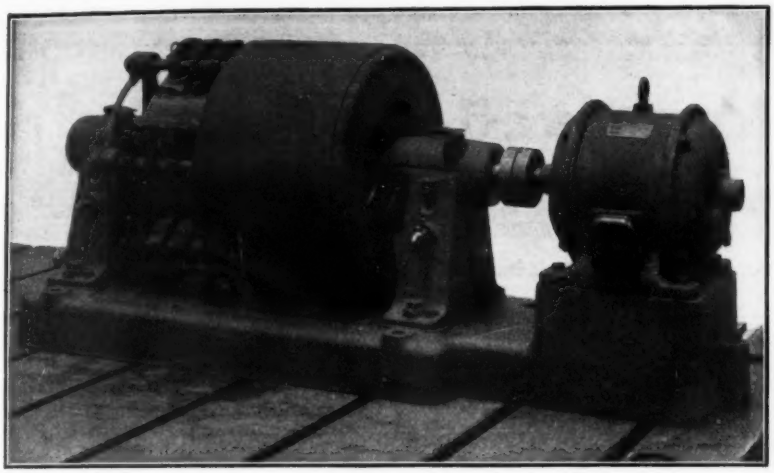


Fig. 4—A 12-Kilovolt-Ampere Compensator for a 600-Horsepower Motor; Driving Motor is One Horsepower.

the speed at which the revolving field cuts the winding in the device. If we reduce the relative speed of field and winding by turning the latter in the same sense as the field, the reactance and accordingly the lag decrease. At synchronism the zero value of reactance is reached. Should the speed exceed that of synchronism, the reactance takes a negative value, and the device acts as a capacity and produces a leading current. Considering that the current brought to the device has a frequency corresponding to the slip of the principal motor, or from one to three cycles, while the speed of the device is chosen so that its frequency of rotations reaches 30 to 50 cycles, it is seen that there is produced a current with a large lead. Such current serves as a magnetizing current for the main motor, and this latter takes only the energy or working current from the lines.

One unusual point about the rotary compensator is that in principle it does not require a stator. However, in order to have a closed path for the lines of force, there is used a solid iron ring around the rotor.

Fig. 2 shows the principal wiring connections for a motor which is compensated in this way. The main motor *A* is connected to the mains through the usual apparatus. The compensator *B* is coupled to the last contacts of the starter *C* so that when once the start is made, the rotor of the main motor is connected to the compensator by working the starter handle. For heavy currents, or when the compensator is used on an existing motor, a special collector is necessary. An electric interlock device *E* prevents starting the main motor before the compensator group rotates and before the starting box is in the start position, avoiding all false moves in this way. In general, a small separate driving motor *AM* is mounted on the same base with the compensator.

The principal advantages of the Brown-Boveri system are its simplicity and safety of operation; also that its good ventilation allows of designing it to take a large overload, hence it has a small size compared with the power it has to take care of. It is to be noticed that an induction motor compensated in this way keeps all the properties of a non-synchronous motor, so that the slip increases with the load, preventing hunting oscillations and uncoupling. The power-factor remains practically equal to unity for all loads and without any supplementary adjustments, see Fig. 3. The system is especially applicable for use with slow-speed induction motors. In ordinary cases, to obtain a relatively high power-factor, the motor must be more liberally designed than its heat limit would call for, so that for this reason it has not been possible to build motors for every slow speeds above a certain size.

For use in factory plants where the motors are working on a poor power-factor the Brown-Boveri method is a most practical one. It should be noted, however, that if the slip rings of the main motor have to take all the current of the rotor, such rings should be reinforced in some cases. In the case of very large motors where an extra amount of slip is desired, for instance for rolling-mill motors in order to work well with the masses of the flywheel, it is preferable to provide the device with a stator winding, and here the compensator has two commutators on account of the heavy current used. This construction is also employed with advantage in the cases where it is desired to use the compensator to provide for the power-factor of a whole set of mains. In such case the device not only has to provide the magnetizing current for the principal motor but for all the other motors connected on the mains. The present method is not to be applied when the speed of the main motor is to vary between wide limits, but outside of this, it has already received numerous applications, especially for factory-motor work.

It is very peculiarly suitable for compensating heavy motors running at slow speed, such as for operating piston pumps, compressors, defibrating machines in paper and cellulose works, rolling-mill sets, and others. In one instance a 400-horsepower motor was coupled direct to a wood-defibrating machine, and its power-factor was brought to unity by the use of a small motor and compensator set.

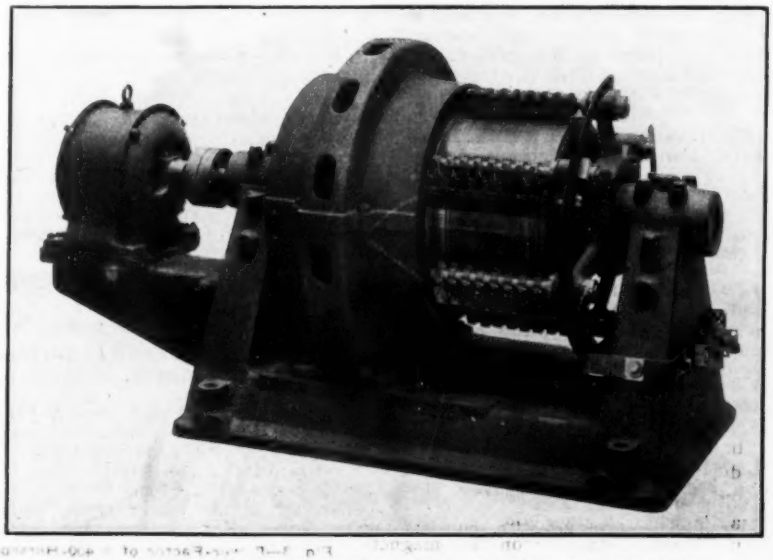


Fig. 2—A 30-Kilovolt-Ampere Compensator for a 1,200-Horsepower Motor.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

GROUND CLAMPS.—Ernest Klein & Brother, 44 Fulton Street, New York, N. Y.

"Klein Adjusto" ground clamp.

A two-piece clamp of copper having the ends secured by a single bolt and provided with a lug for soldered connection to the ground wire. In three sizes, adjustable for use with armored cable, metal molding and pipe or conduit up to three inches in diameter.

Approved February 4, 1914.

HEATERS, Electric.—American Electrical Heater Company, Woodward, Burroughs and Cass Avenues, Detroit, Mich.

Radiators, 250-4,000 watts; catalog No. 6,126.

Glue pots, 500-650 watts; catalog No. 145.

Approved January 17, 1914.

HEATERS, Electric.—American Electrical Heater Company, Woodward, Burroughs and Cass Avenues, Detroit, Mich.

"American Beauty" portable heating devices for voltages up to 250. Equipped with approved heater cord and detaching plugs.

Tea samovar, 450 watts; catalog No. 2,306.

Approved January 19, 1914.

INSULATING MATERIALS.—Mitchell-Rand Manufacturing Company, 99 John Street, New York, N. Y.

Sealing compounds.

"Leverite," melting point in excess of 200 degrees Fahrenheit.

"M R-50," melting point in excess of 150 degrees Fahrenheit.

Standard for sealing screw heads, nuts, bolts and other live metal parts of electrical fittings where such sealing by compounds having these melting points is required by the rules of the National Electrical Code.

Approved February 2, 1914.

INSULATING MATERIALS.—Mitchell-Rand Manufacturing Company, 99 John Street, New York, N. Y.

Sealing compounds.

"M R-40," a non-plastic material having a melting point below 150 degrees Fahrenheit. For battery sealing and for similar purposes, but not for sealing live parts in electrical fittings.

Pothead compound, a black, plastic compound, having a melting point of about 150 degrees Fahrenheit. For use in potheads, cable terminals and for battery sealing but not for sealing live parts in electrical fittings.

Approved February 3, 1914.

LAMP ADJUSTERS.—Adolph Cohn, 552 Summit Avenue, West Hoboken, N. J.

The "Rela" lamp adjuster, consists of a spring socket holder hooked to a short chain which in turn is secured to the end of an adjustable steel rod.

Approved February 9, 1914.

PICTURE MACHINES AND APPLIANCES.—Thomas A. Edison, Incorporated, Orange, N. J.

Edison kinetoscope, model D. A hand-driven motion-picture machine.

Approved February 3, 1914.

RECEPTACLES, for Attachment Plugs.—E. H. Freeman Electric Company, Trenton, N. J.

Sign-letter connector, catalog No. 103.

A porcelain outlet-box cover with two contact sleeves and individual plugs for the terminal wires of the letter.

Tea Samovar.—American Electrical Heater Company.

Standard for use with stranded rubber-covered wire not smaller than No. 14 B. & S. gauge for the purpose of connecting interchangeable letters or other portions of electrical signs to the supply circuits.

Flush wall receptacle, 660 watts, 250 volts; catalog No. 4,354.

Approved January 17, 1914.

RECEPTACLES, Standard.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" brass-shell, closed or slotted bases, for use on metal ceilings.

Key; catalog Nos. 4,554 and 7,554.

Keyless; catalog No. 7,555.

Pull; catalog No. 4,555.

Also all of the above types with shadeholders attached; key type with composition or insulated metal key.

Approved February 4, 1914.

SIGNS, Electric.—American Sign Company, Fifteenth and Washington Streets, Portland, Ore.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached to each sign.

The manufacturer is equipped to supply these signs so labeled.

Approved January 21, 1914.

SWITCHES, Push-Button Flush.—Chelten Electric Company, 314 Armat Street, Philadelphia, Pa.

The following switches are approved and labeled:

Single-pole, 5 amperes, 250 volts; 10 amperes, 125 volts; catalog Nos. 4,000-A, 5,000-A.

Double-pole, 10 amperes, 250 volts; catalog Nos. 4,001-A, 5,001-A.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts; catalog Nos. 4,002-A, 5,002-A.

Also above types with lock attachment.

Approved January 27, 1914.

SWITCHES, Push-button Flush.—Cutter Electrical & Manufacturing Company, Nineteenth and Hamilton Streets, Philadelphia, Pa.

The following switches are approved and labeled:

"S. F. Improved."

Single-pole, three-way and four-way, 10 amperes, 125 volts; 5 amperes, 250 volts.

Double-pole, 10 amperes, 250 volts.

Also above types with lock attachment.

Approved February 2, 1914.

SWITCHES, Surface Snap.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

The following switches are approved and labeled:

Single-pole, 5 amperes, 125 volts; 3 amperes, 250 volts; catalog Nos. 7,109-14, inclusive.

Approved February 4, 1914.

SWITCHES, Surface Snap.—Manhattan Electrical Supply Company, 17 Park Place, New York, N. Y.

The following switches are approved and labeled:

Single-pole; catalog Nos. 5,121-24, inclusive.

Double-pole; catalog Nos. 5,125-28, inclusive.

Three-point; catalog Nos. 5,129-30.

Four-point; catalog Nos. 5,131-32.

Two-circuit; catalog Nos. 5,133-36, inclusive.

Three-circuit; catalog Nos. 5,137-40, inclusive.

Approved February 3, 1914.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

BELLINGHAM, MINN.—An electric light plant will be established here by L. F. Clark. C.

LOHRVILLE, IOWA.—A municipal lighting plant will be established. Address the city clerk.

MINATARE, NEB.—The question of a municipal lighting plant is now being agitated. Address the city clerk.

CORDELE, GA.—J. J. Williams and J. W. Canon are members of a committee appointed to secure improved lighting.

NOONAN, N. D.—George Todd, of Minot, has a contract to install a "White Way" lighting system at this place. C.

THATCHER, ARIZ.—March 14 the question of granting an electric franchise will be submitted to a vote. Address the city clerk.

ISANTI, MINN.—Allenn & Lovic, of Pine City, have made a proposition to the Council to extend the power line from Grandt to this place.

HAVANA, ILL.—Officials of the city of Havana are figuring on the advisability of building a municipal lighting plant. Address the city clerk.

TEXAS CITY, TEX.—The merchants are planning to install ornamental lighting on Sixth Street. Address the mayor in regard thereto.

LA CROSSE, WIS. — Wisconsin Railway, Light & Power Company will erect a new substation to cost $15,000. Peter Valier is general manager. C.

McARTHUR, O.—The McArthur Brick Company will erect a power house and install two boilers and a 300-horsepower engine and generator according to reports. R.

MEDICINE HAT, ALTA.—Plans are being made at the office of the City Engineer for an electric distributing system to cost $10,000 and a street-lighting system to cost $20,000.

LOWELLVILLE, O.—The Mahoning & Shenango Railway & Light Company has contracted to build a $100,000 power house here. The company is in the market for new machinery and general equipment. R.

CARLSBAD, TEX.—Plans are being made by the State Board of Managers of the State Tuberculosis Colony here for a heating and electric plant costing $10,000, and additions to the power house. D.

DALLAS, TEX.—The Commissioners' Court of Dallas County has ordered the erection of a power plant to supply the new county jail and the court house with power and light. It will cost about $25,000. D.

ELK RIVER, MINN.—F. D. Waterman, owner of the Elk River Water Power Company, will begin operations in the spring to develop the water power, generate electricity and provide light and power for this village if arrangements can be made. C.

PHOENIX, ARIZ.—The Pacific Gas & Electric Company of this city has just informed the Arizona Corporation Commission that it will in the near future set aside $100,000 for extensions and improvements to its system. T.

CHELSEA, MASS.—A bill introduced by Representative Beck authorized the Metropolitan Park Commission to construct and maintain a plant for furnishing electric lights for use on the parkways under its jurisdiction.

CANTON, O.—Mayor Stolberg is going to take up and consider plans for the installation of a municipal lighting plant within the next five months. He has so advised Engineer H. Whitford Jones, of Cleveland, who has prepared a tentative plan. R.

URBANA, O.—The Urbana Light Company plans to extend its lines between Cuyahoga Station and Mechanicsburg to furnish power to the 250-horsepower motors there and light to the residents along the line. A contract for the turbine engine is to be let. R.

JACKSONVILLE, FLA.—The Council will build a pump house and electric substation. Plans have been prepared by Architect Sargent Hamilton and bids will be advertised for. The estimated cost is $35,000. Address Frank Richardson, chairman of the Board.

ALTON, KANS.—The firm of Rollins & Westover, consulting engineers, of Kansas City, has been engaged to furnish the approximate cost of installation, maintenance, revenue, procedure, etc., of the proposed waterworks system and electric light plant. The bonds will likely call for $25,000.

NEWPORT, R. I.—A committee on the budget of this city has recommended to the city government the installation of 100 luminous arc lamps, with artistic fixtures, on Belleview, Harrison and Ocean Avenues and Ridge Road, six new arcs on Third Street and a general improvement of lighting Thames Street in the business section. W.

COLORADO SPRINGS, COLO.—A plan to construct a large power plant in the Cripple Creek district to supply power and light for its own use and for other large consumers is under consideration by the Portland Gold Mining Company. The estimated cost of the plant is from $200,000 to $250,000. If it is decided to build work will start immediately.

EAST WORCESTER, N. Y.—The Great Bear Light & Power Company is making arrangements to improve its plant by building a new dam at the Ferris pond in the town of Decatur early in the spring. It will also build a line through to Schenevus and operate the Schenevus plant from the main plant at East Worcester, giving an all night service to the villages of East Worcester, Richmondville and Schenevus.

RIVERSIDE, CAL.—Residents of Seventh Street, the main inlet to this city on the west, are preparing to establish along that thoroughfare a system of ornamental electroliers to cost about $4,000. Assessments are now being collected for the lighting system on Tenth Street, which amount to approximately $4,000. T.

NEWPORT, ORE.—A. Welsh has purchased the Yaquina Electric Company's plant at Newport, and has secured water rights on the Siletz River in Lincoln County. Mr. Welsh intends to begin the construction of the first unit of a $150,000 hydroelectric plant to supply Newport and surrounding country with electricity and power. The first unit will be built to develop 2,500 horsepower.

HADLEY FALLS, MASS.—The special committee on the acquisition of a municipal electric light plant has received propositions from companies in western Massachusetts to furnish energy. It is reported that several mills in the town will operate by electricity when the plant is put in operation. Among them is the Lynch & Ranger brick yards, which proposes to use motors for running the machines.

SOUTH PASADENA, CAL.—All of the public utilities corporations of this city have been informed that an ordinance, which will be rigidly enforced, has just been passed ordering them to remove all of their poles from the streets, putting them either in alleys or running the lines in underground conduits. It is understood that the underground method is favored by most of the corporations.

SAN FERNANDO, CAL.—The San Fernando Mission Land Company and John T. Wilson have made application to the State Railroad Commission for the authority to consummate deals whereby they will sell to the Pacific Light and Power corporation their holdings at this place. After these deals are completed the new owners will make extensions and improvements to these particular sections of the system.

VESTABURG, MICH.—A move is on foot here by the Alma Illuminating Engineering Company, a copartnership of Alma, to erect a power plant near Riverrdale to utilize the Pine River power developed at the J. W. Robinson dam. H. S. Connor, manager of the company, says that arrangements have been made for the erection of pole lines to carry the current for light and power to Vestaburg, Riverdale, Elm Hall, Sumner, Elwell, Winn, Cedar Lake and possibly to Edmore and Alma. The possibilities in the power line are great enough to warrant the resurrection of the old Coldwater and Marshall Railroad Company, whose roadbed was

graded from Coldwater to a point within one-half mile of this dam nearly 40 years ago.

DRESDEN, TENN.—A $27,000 light and water system will be established. Address the mayor.

FOREST LAKE, MINN.—C. E. Stewart is interested in establishing an electric light plant here. C.

GREER, S. C.—Bids will be received for the construction of an electric light plant here. Address the mayor for particulars.

HOOPER, NEB.—A new company is being organized to furnish the town with electric light. Address Harris & Pope for information.

LEESBURG, GA.—An election will be held to vote on issuing bonds for establishing an electric light plant here. Address the mayor.

NEW GERMANY, MINN.—An electric light system will be installed here and the New Germany Auto Company will furnish the power. C.

HARMONY, MINN.—The Council is considering a bond issue for an electric light system. Ornamental lighting will be installed on three blocks of Main Street. C.

QUENEMO, KANS.—In its second referendum vote the town of Quenemo voted to grant a franchise to an Ottawa Electrical Company to extend an electric light line from Ottawa to that town.

LOS ANGELES, CAL.—Articles of incorporation have been filed here for the International Electric Lighting Company, with a capital stock of $500,000, by T. L. Croom, B. T. Wilson, D. W. Shoemaker, M. W. Janicke and Mary W. Croom.

MASON CITY, IOWA. — Mayor John Stanton has called a special election for March 26 to vote on the proposed $65,000 bond issue. About $50,000 is wanted for equipping the municipal electric plant.

GLENDIVE, MONT.—A new heat, light and power plant which will represent an investment of $75,000 will be constructed during the coming summer by the Glendive Heat, Light & Power Company. The plant is owned by the Hughes Brothers.

INDIANAPOLIS, IND.—The Muellerschoen Home Electric Light Company has been incorporated at $50,000 for the purpose of operating individual electric lighting plants. The incorporators are Charles Muellerschoen, John M. Ahlgren and H. V. Royal.

SPRINGFIELD, ILL.—A petition for the erection of an ornamental street-lighting system in Adams street from Lewis to Tenth Streets was filed by Mayor Schnepp with the Board of Local Improvements. The petition calls for five-lamp standards in the business district and for three-lamp posts in the residence district.

GREENVILLE, O.—The stockholders of the Greenville Electric Light & Power Company voted an increase of $40,000 in their capital stock. This will be used in making further extensions of lines and other improvements. The plant in this city is now furnsihing light and power to seven other towns and cities. It is expected that they will add other towns to their service.

WILMOT, MINN.—The City Council has approved the plans of the Water and Light Commission to replace the present electric equipment with the latest machinery with the added capacity needed to take care of the increasing demands of the patrons of the city plant. The expenses of this improvement will reach about $14,000. Address the city clerk.

BISHOP, CAL.—The State Water Commission has granted preliminary permits to C. O. Poole, acting for the Southern Sierra Power Company, to appropriate 300 second feet of water on Big Pine Creek and the same amount on Baker Creek. The power company filed an estimate of the cost of the Big Pine project at $1,300,000, and of the Baker Creek project at $550,000.

LOS ANGELES, CAL.—The Southern California Edison Company has just been granted permission by the State Railway Commission to issue bonds to the amount of $1,500,000, the money derived from the sale of these bonds to be used in improving and extending the company's system. The delivery of these bonds is being cared for by R. H. Ballard, secretary and assistant general manager of the company, and H. H. Trowbridge, counsel.

MILLSBURY, MASS.—The Connecticut River Transmission Company is to construct a new line of poles and wires from the substation of the company on Providence Street to the south works of the American Steel & Wire Company, Worcester, to furnish additional electric power for the concern. Plans are all made to begin the work as soon as weather conditions are favorable. The line will be five miles long, and will be what is known as the three-phase circuit. A representative of the company has stated that the rights of way and pole locations have been secured, and all is in readiness to start work early in the spring. He also stated that work will be started.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OSKALOOSA, IOWA.—The Home Telephone Company is preparing to install an underground conduit system.

ALEXANDER, N. D.—The Dakota Northwestern Telephone Company will install a telephone exchange here in the spring. C.

HICKORY, N. C.—The Sandy Ridge Telephone Company has been organized here. G. C. Pickard is president and J. E. Huffman, secretary.

MENAHGA, MINN.—The Latona & Twin Lakes Telephone Company has been incorporated with a capital stock of $5,000. A. Burt is president.

MASON CITY, IOWA.—The Way Martin Telephone Company has been incorporated with a capital stock of $5,000. B. C. Way is president.

DENTON, N. C.—The Denton Telephone Company has been incorporated with a capital stock of $25,000 by J. F. Cameron, J. W. Cashatt and others.

PORT BYRON, N. Y.—The Port Byron Telephone Company has purchased the Warren property and will immediately erect a new office building.

THREE FORKS, MONT.—The Farmers Telephone Company has been incorporated with a capital stock of $40,000 by R. S. Rutcher, R. A. Young and others.

EUREKA, MONT.—Directors of the Eureka Mutual Telephone Company are considering building an extension up St. Clair Creek and to Gateway.

CHARLESTON, ILL.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $1,300 by F. H. Rehue, A. S. Ingram and others.

STREETMAN, TEX.—The Streetman Telephone Company has been incorporated with a capital stock of $5,000 by C. A. Elliott, R. M. Thompson and S. G. Ward.

MARSHALL, MINN.—The Sodus Rural Telephone Company has been organized with A. O. Killius, president; Hugh Edwards, vice-president, and S. E. Boyle, secretary. C.

LORIMORE, IOWA.—The Macksburg & Lorimore Mutual Telephone Company has been incorporated with a capital stock of $6,000 by A. Leonard, A. Nitzsche and others.

MILLVILLE, N. J.—The City Commission has made an appropriation of $2,200 for the installation of a police and fire-alarm system. Bonds for this and other municipal improvements have been approved. A.

WARROAD, MINN.—Warroad Telephone Company is making plans to extend its line from Clementson to International Falls, work to begin in spring. Messrs. Fox and Jewett are the owners. C.

DAYTON, O.—The Dayton Home Telephone Company has directed the engineering firm of McMeen & Miller to prepare plans for extending the service. Address A. McL. Marshall, director.

THOMASVILLE, GA.—The Consolidated Telephone & Telegraph Company has been incorporated with a capital stock of $250,000 to acquire and erate telephone systems. R. L. Stewart is general manager.

STEELTON, PA.—The Council has voted to establish a central police station and to install a system of red lights and telephones throughout the borough to increase the efficiency of the police department. Address T. J. Nelly, chairman of the Police Committee, for further particulars.

INTERNATIONAL FALLS, MINN.—Border Telephone Company has been incorporated with a capital of $10,000. A. H. Hanson is president; Albert Schonsby, treasurer. It is proposed to build a line from Loman to Clementson, a total distance of 45 miles. C.

TAMPA, FLA.—The Peninsular Telephone Company will improve the system. A bond issue of $250,000 has been made. Extension of the lines to Bartow, the Manatee section and to the west coast has also been under discussion and the lines will be extended in these directions as the work of improving the entire system goes along. Address J. H. Detwiler, director, for further information.

SIDNEY, MONT.—The Water Users Electric Company, of Sidney, will build a telephone line to Lambert and Enid. Work will commence early in the spring. Address President Kemmis for particulars.

VALDEZ, ALASKA.—Lieut. Dougherty, U. S. A., here, in charge of the Military cable and telegraph line, has been instructed to construct a telegraph line from this city to Fort Liscum. Master Electrician Stocker will have charge of the installation, which will be a combination telephone and telegraph line. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LEWISTON, IDAHO.—The Nezperse & Idaho Railway Company is preparing to build 12 miles of line out of this city.

STURGEON BAY, WIS.—E. W. Olberg is preparing surveys for the construction of a proposed electric railway to connect Sturgeon Bay and Liberty Grove.

SARNIA, ONT.—The Sarnia Street Railway Company is preparing to extend its line along the river bank of Sarnia. William Williams is chief engineer.

NATCHITOCHES, LA.—The citizens of this place are backing the construction of an interurban railroad between Natchitoches and Campti, La., on the Red River, south of Shreveport. D.

MADISON, IND.—L. S. Cook has plans for the construction of an interurban line to Cincinnati, Ky., covering a farming district in the Ohio Valley at present is without rail facilities.

EVANSVILLE, IND.—The Evansville Railway Company is planning to construct an electric railway to connect with the Evansville-Rockport line. Address William A. Carson, general manager.

UVALDE, TEX.—The Uvalde & Leona Valley Interurban Railway Company will construct an electric railway from Uvalde to Batesville, about 22 miles. Address J. H. Gearhart, general manager.

COLORADO SPRINGS, COLO.—An electric line from Colorado Springs to Florence and Canon City, with a branch from Florence to Pueblo, may be built this spring. Address E. W. McClung, chairman, for information.

NORRISTOWN, PA.—A new trolley road from this, the county seat of Montgomery, to Doylestown, the county seat of Bucks, is rumored as a contemplated extension to the tracks of the Reading Transit Company.

SAN FRANCISCO, CAL. — The Ocean Shore Railroad Company has applied to the Railroad Commission for permission to issue $200,000 in bonds, the proceeds of which are to be used for the electrification of its road from this city to Halfmoon Bay.

BARABOO, WIS.—The Baraboo, Devil's Lake & Western Railway Company expects to start operations to extend its line from Portage to Baraboo, Devil's Lake, Kilbourn and The Dells. T. E. Mead and T. F. Risley are interested.

SANTA ROSA, CAL.—Surveying has begun on a new electric line to run from Graton to Camp Meeker in connection with the present Petaluma and Santa Rosa Electric Railway. The road will be seven miles in length, and will cost in the neighborhood of $200,000.

BRENHAM, TEX.—The Young Men's Business Association of Brenham is promoting the construction of one or more interurban lines out of Brenham to other points in Washington County. Frank Eberle is secretary of the Association.

CONCORD, N. H.—It is reported that Boston capitalists will finance the building of the proposed Concord, Northwood and Dover street railway in New Hampshire. The town of Northwood has at present no railroad facilities, and contains two extensive shoe factories. The survey of the line skirts Suncook pond, in that town, where about 75 summer cottages are being built. The line is designed for freight traffic as well as for passengers, and it is the object of the promoters to utilize it for the transportation of coal from the seaboard to interior New Hampshire points. W.

SHELBYVILLE, KY.—At a meeting of directors of the Business Men's Association of Shelby county, the project for an electric line between the Shelbyville and Mt. Eden was revived and steps taken to put the proposition on a business basis.

SHERIDIAN, WYO.—An interurban electric railway from Sheridian up the Big Goose Valley to Absaraka Park may be built in the near future. Secretary Steele of the Commercial Club may be addressed in regard to the project.

EVANSVILLE, IND.—A survey for the extension of the Evansville and Rockport traction line from Kincaid, Ind., to a point opposite Owensboro, Ky., is being made. It is expected the spur will be built some time this year. The estimated cost of construction is $250,000.

MADISON, WIS.—The Janesville & Madison Traction Company has been incorporated with a capital stock of $25,000 by Dr. Gustav Pickhardt, Frank Weston, J. W. Pepper and J. H. Aubey. An interurban road is to be built from Janesville to Madison. It is understood that a considerable portion of the road is to be completed by the summer.

PETALUMA, CAL.—What will mean a new era of development to western Sonoma County, and a boon to practically every section of Imperial Sonoma, has been inaugurated by the surveying of a new electric railroad from Graton to Camp Meeker. This road will connect with the Retaluma & Santa Rosa Railroad at Graton and will run for a distance of seven miles westward.

HARRISBURG, ILL.—Information was given out from the general offices of the Southern Illinois Railway & Power Company here that work on the extension of the road from here to Marion, Whiteash, New Virginia, Johnson City, West Frankfort, Benton and Herrin will begin April 1. Address the general manager, this city, for further particulars.

PACKETTSTOWN, N. J.—The opening of the trolley connection to Lake Hopatcong will no doubt soon be followed by construction to connect with the system from Hackettstown, and a journey by trolley to Harrisburg will soon be practicable. The route now available is extremely attractive, passing through Summit, Chatham, Madison, Morristown, Dover, to the Lake thus opening to the public at a low rate some of the pleasantest sections of New Jersey and some scenery that is not excelled for general charm anywhere.

PITTSBURG, PA.—Active operations will be started early in the spring on the building of an electric line from Williamsport, Md., through Martinsburg, Winchester, Strasburg, Woodstock and southward as far as Harrisonburg Va. The syndicate which is known as the Shenandoah Valley Railway Company is also contemplating running a spur of the road into Washington, D. C., making connection with the southern terminal of the Washington & Old Dominion Electric Railway at Bluemont.

PROPOSALS.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until April 1 for furnishing the interior lighting fixtures of a one-story building for the postoffice at Clarksville, Tex.; and until April 3 of a one-story building for the postoffice at Sycamore, Ill., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites or the Supervising Architect.

ELECTRIC DISRIBUTION SYSTEM.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., endorsed "Proposals for an Underground Electric Distributing System," until March 14 for an alternating-current electric distributing system and transformers, cables, motors, and two feeder panels for the Naval Training Station, Newport, R. I. The estimated cost is $8,100. Plans and specifications may be obtained upon application to the Bureau or to the Commandant of the Naval Station named.

NEW INCORPORATIONS.

DALLAS, TEX.—Carroll Electric Company has been incorporated with a capital of $5,000 by E. A. Corley, W. M. Jones and W. G. Carroll.

BROOKLYN, N. Y.—Louis Kalischer, Incorporated, has been incorporated with a capitalization of $20,000 to engage in electrical contracting. The incorporators are Louis Kalischer, Joseph Milbouer and Louis Florance, of Brooklyn.

NEWARK, N. J.—The American Metal Moulding Company has been incorporated with a capital of $50,000 to manufacture metal conduits for electric wires. C. A. Reibovitz, G. A. Johnson and Clarence Hanson are incorporators. A.

WARREN, O.—The Luse Electric Company has been incorporated with a capital of $5,000 to do a general installation business. The incorporators are Howard M. Luse, Mary A. Luse, J. E. Beebe, George T. Fillius and J. G. Bates.

NEW YORK, N. Y.—Bateman & Miller Electrical Company, Incorporated, has been incorporated to engage in the electrical-contracting business. The incorporators are Charles E. Bateman, John Miller, of New York City; and Charles F. Hulseman, Brooklyn.

ANDERSON, IND. — Powell & Dorste, Incorporated, has been granted articles of incorporation with a capital stock of $25,000. The company will engage in the electrical and heating supply business. The directors are Walter H. Powell, Robert Forste and Louis T. Dorste.

CLEVELAND, O.—The Cleveland Electrical Exposition Company has been incorporated with a capital stock of $4,000 for the purpose of conducting electrical expositions. The incorporators are William G. Rose, Hubert C. Mohr, Harry L. Weiss, B. Grebe and M. E. Turner.

NEW YORK, N. Y.—Electro-Acoustic Company, Incorporated, has been incorporated with a capital stock of $100,000 to manufacture electrical devices for receiving and recording sound. The incorporators are Richard S. M. Mitchell, Newark, N. J.; Henry W. Showers and Bayard Stevens.

FINANCIAL NOTES.

The National Carbon Company has been authorized to increase its preferred stock from $4,500,000 to $5,600,000 and the common from $5,500,000 to $12,000,00.

A committee of Philadelphia electric stockholders has been formed to ask the United Gas Improvement Company to reopen the lease offer made a year ago, and to negotiate this time direct with the shareholders of the electric company.

The Third Avenue Railway Company has received permission from the New York Public Service Commission to issue $4,000,000 bonds to replace money expended in obtaining control of the Belt Line Railroad and the New York City Interborough Railroad Company. The company's original application called for an issue of $6,650,000. The remaining $2,650,000 has not been refused, but is held in abeyance pending further hearing and investigation.

J. P. Morgan & Company have sold $10,000,000 Interborough Rapid Transit first and refunding mortgage fifty-three-year five-per-cent bonds to the distributing syndicate, consisting of Lee. Higginson & Company, William R. Read & Company, Harris, Forbes & Company, Kissel, Kinnicutt & Company, and White, Weld & Company. To cover the Interborough's requirements under the dual subway plan, the company sold to J. P. Morgan & Company and through them to the above syndicate, $170,000,000 of the new first-mortgage bonds, to be taken and paid for in four yearly installments, viz: In 1913, $78,000,000; in 1914, $30,000,000; in 1915, $30,000,000, and 1916, $32,000,000. The amount of the bonds already sold to the public is $30,000,000, and the new issue will bring it up to $40,000,000.

Announcement is made by Kelsey, Brewer & Company, of Grand Rapids, Mich., operators of the American Public Utilities Company, that they have acquired for that corporation the Electric Railway properties of the Chippewa Valley Railway, Light & Power Company, operating street railways in Eau Claire and Chippewa Falls, together with an interurban line connecting these two towns, a distance of 22.5 miles. It is also announced that other properties have been acquired, including the Chippewa Falls Waterworks & Light Company, the Menominee Electric Light & Power Company, the hydroelectric plant at Menominee and power rights along the Red Cedar and Chippewa Rivers and other public utilities in Menominee. Elmwood, Spring Valley and other small towns in Minnesota. The deal involves about $3,000,000, and the new properties will be taken over and operated by the American Public Utilities Company. Some new financing by the American Public Utilities Company will be announced soon in connection with the acquisition of these properties.

Kelsey, Brewer & Company, operators of the American Public Utilities Company, Grand Rapids, Mich., have closed a deal whereby they now control practically all the public utility rights in the Mississippi Valley between La Crosse, Wis., and St. Paul, Minn., thus furnishing an outlet at the twin cities for the immense capacity of the Mississippi Valley between the cities mentioned, a territory rich, prosperous and growing. In addition to the already extensive holdings of the American Public Utilities Company in Minnesota, the new deal takes over all the trolley properties of the Chippewa Valley Railway, Light & Power Company, which operates the street railway in Eau Claire and Chippewa Falls, together with the interurban line between these two cities, a distance of twenty-two and a half miles; the Chippewa Falls Water Works & Light Company, the Menominee Electric Light & Power Company, the water power plant at Menominee, and rights along the Red Cedar and Chippewa rivers with a capacity developing approximately 100,000 horsepower of electric current, together with other public utilities in Menominee, Elmwood, Spring Valley and other small towns which represent extensive gas and electric plants and manufacturing interest. The deal covers an approximate investment of $3,000,000. These new holdings will be operated by Kelsey, Brewer & Company in addition to those already controlled in Minnesota and Wisconsin.

Dividends.

Central Mississippi Valley Electric Company; initial of $1.50 on preferred, payable March 2 to stock of record February 21.

Cities Service Company; monthly of 0.5 per cent on preferred and 0.5 per cent on common, payable March 1 to stock of record February 15.

Electric Storage Battery Company; quarterly dividends of one per cent on both the common and preferred stocks, payable April 1 to stock of record March 23.

El Paso Electric Company; quarterly of $2.25 on the common, payable March 16 to stock of record March 4.

National Carbon Company; a 50 per cent stock dividend, payable on March 20. The company's surplus recently was increased substantially by the liquidation of certain assets.

Philadelphia Company; regular quarterly of 1.75 per cent, payable March 14 to stock of record February 21.

Philadelphia Electric Company, regular quarterly of 1.75 per cent, payable March 14 to stock of record February 21.

West Kootenay Power & Light Company, Limited; a quarterly dividend of 1.25 per cent, payable March 2.

Reports of Earnings.

REPUBLIC RAILWAY & LIGHT.
(Subsidiary Companies.)

	1914	1913
January gross	$ 257,978	$ 244,340
Net after taxes	105,699	95,774
Surplus after charges.	62,610	49,958
12 months' gross	3,011,306	2,710,157
Net after taxes	1,163,630	1,076,851
Surplus after charges..	630,093	546,865

DETROIT EDISON COMPANY.

	1914	1913
January gross	$ 603,326	$ 500,573
Net after taxes	281,468	238,732
Surplus after charges.	216,439	175,249
Depreciation	43,350	43,350
Balance	173,089	131,899

MILWAUKEE ELECTRIC.

The railway department of the Milwaukee Electric Railway & Light Company reports for the year ended December 31, 1913, compared as follows:

	1913	1912
Gross	$ 4,221,311	$ 4,131,811
Net after taxes	1,057,011	1,218,600
Other income	11,927	29,463
Total income	1,068,938	1,248,064
Surplus after charges	570,278	691,694

The earnings of the light and power department of the Milwaukee Electric Railway & Light Company for the year ended December 31, 1913, compared as follows:

	1913	1912
Gross	$ 1,795,606	$ 1,550,545
Net after taxes	753,470	533,694
Other income	33,252	31,726
Total income	786,722	565,420
Surplus after charges	552,059	406,583

GRAND RAPIDS RAILWAY.

	1913	1912
December gross	$ 121,731	$ 106,978
Net after taxes	50,140	41,370
Surplus after charges	37,719	27,118
12 months' gross	1,294,347	1,233,588
Net after taxes	497,796	533,358
Surplus after charges	331,163	358,133
Balance after preferred dividends	256,163	283,133

NEW YORK TELEPHONE COMPANY.

The report of the New York Telephone Company for the year ended December 31, 1913, compares as follows:

	1913	1912
Phone revenue	$46,831,034	$43,223,623
Expenses and tax	34,834,428	31,276,208
Net telephone earnings	11,996,606	11,947,415
Dividends and interest	5,770,395	5,356,176
Miscellaneous earnings	15,278	9,579
Total net earnings	17,782,279	17,313,170
Interest charges	3,494,695	2,951,845
Balance	*14,287,584	14,361,325
Dividends	10,000,000	10,000,000
Surplus	4,287,584	4,361,325

*Equal to 11.43 per cent on $125,000,000 capital stock, as compared with 11.48 per cent on same stock previous year.

President U. N. Bethell says:

"On Dec. 31, 1913, there were 1,082,765 stations in the system directly operated by your company and its local connecting companies, an increase during the year of 96,985. Including the associated and connecting companies, there were in service in the whole system at the end of the year 1,931,984 stations, an increase during the year of 175,641 stations.

"Under the plan for enployee's pensions, disability benefits and insurance, adopted January 1, 1913, there has been paid out from the fund during the past year $224,439. The interest added amounted to $76,358, leaving a balance of $148,081, which has been appropriated to restore the fund to its original amount of $2,000,000."

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 23	Feb. 16
American Tel. & Tel. (New York)	121	120
Commonwealth Edison (Chicago)	136	135⅞
Electric Storage Battery, common (Philadelphia)	53¾	55
Electric Storage Battery, preferred (Philadelphia)	53¾	55
General Electric (New York)	149¼	148
Kings County Electric (New York)	120¼	120
Manhattan Transit (New York)	1	1
Massachusetts Electric, common (Boston)	11	11
Massachusetts Electric, preferred stamped (Boston)	62¼	62
National Carbon, common (Chicago)	158	150
National Carbon, preferred (Chicago)	117	118
New England Telephone (Boston)	139	140
Philadelphia Electric (Philadelphia)	26¾	26⅞
Postal Telegraph and Cables, common (New York)	86½	84¾
Postal Telegraph and Cables, preferred (New York)	70	69
Western Union (New York)	64½	64¼
Westinghouse, common (New York)	71¼	70
Westinghouse, preferred (New York)	116	115

PERSONAL MENTION.

MR. CONRAD HUBERT has been elected a vice-president of the National Carbon Company, succeeding Webb C. Hayes.

MR. HENRY MADISON, formerly with the Newton Gas and Electric Company,, Newton, N. J., has been appointed chief electrician at the new municipal lighting plant, Franklin Borough, N. J.

MR. GEORGE P. TRAYNER has resigned his position in the commercial department of the Utah Light & Railway Company and has gone on the road for the Lambert Paper Company of Salt Lake City.

MR. C. R. FAIRCHILD, district manager of the Bell Telephone Company at Trenton, N. J., gave a stereopticon lecture on the uses of the telephone at the Grange meeting, Pennington, N. J., February 14.

MR. W. L. OVERMAN, representative of the Hughes Electric Heating Company, was recently in Salt Lake City, effecting arrangements with the Western Electric Company's local house to handle that line of electric ranges in this territory.

MR. T. L. BISSELL has resigned his position in the commercial department of the Utah Light & Railway Company, and has taken the agency for several lines of contractors' machinery for the state of Ohio. Mr. Bissell has returned to the East to take up this line of work.

MR. J. O. PRESBY, representative of the Holophane Works of the General Electric Company, with headquarters in San Francisco, has recently been in Salt Lake City covering the trade in this territory. He reports business conditions here strong and improving.

MR. THOMAS A. EDISON has gone to the Everglades of Florida, where, with Mrs. Edison, Miss Madeleine and Charles and Theodore Edison, he will spend a vacation of six weeks. Headquarters will be at Fort Myers, where a temporary laboratory has been set up.

MR. HOMER E. NIESZ, Jovian Statesman for Chicago and president of the Chicago Jovian League, was the speaker at the luncheon meeting of the St. Louis League of Electrical Interests-Jovian Chapter on Tuesday, February 24. His subject was "Practical Jovianism."

MR. RAY KAUFFMAN, well known in Ohio electric circles, and a graduate of the Case School of Applied Sciences, Cleveland, O., class of 1904, has accepted a position with the Electrical Maintenance Company, of Youngstown, O. His last connection was with the Western Electric Company.

MR. O. P. WILSON has accepted the position of assistant general manager of the Norma Company of America, New York, N. Y., manufacturer of ball-bearings, roller-bearings, precision instruments, etc. He was connected with the Westinghouse Electric & Manufacturing Company for 14 years, for the last 10 years in the purchasing department.

MR. W. E. BLODGETT, assistant secretary of the Utah Light & Railway Company, has returned from a trip to Los Angeles and San Francisco. He took occasion while there to investigate the progress in the lighting, power and street railway development, and was particularly impressed with the rural distribution of the systems there and the high voltage of the main transmission lines.

MR. J. H. W. REES has been made general manager of the United Electric Lamp Company, Brooklyn, N. Y. Mr. Rees is well known in commercial and industrial fields and brings to the company a wide experience and aggressive personality. He was until recently advertising manager of Denth & Company. importers of incandescent lamps, and was formerly executive advertising manager of the National Progressive party.

MR. JAMES B. DUKE, president of the Southern Power Company, and MR. SAMUEL McROBERTS, vice-president of the National City Bank, New York, have completed a tour over the Piedmont & Northern Railway, in North and South Carolina. The lines of this property have been opened as far south as Spartanburg, over which the officers made the initial trip, accompanied by Mr. W. S. LEE, vice-president and chief engineer of the Southern Power Company. This interurban company connects most of the cotton manufacturing towns in the Piedmont districts of the two Carolinas.

MR. S. T. WHITAKER, local manager of the Utah Light & Railway Company at Ogden, has returned from a two-week trip to California points. While the main objects of his journey were rest and recreation, Mr. Whitaker spent considerable time looking into matters pertaining to the electric light, power and gas business. Owing to his previous position as director of the special exhibit of the State of Utah at several large fairs, he was particularly interested in the progress of the Panama-Pacific Exposition and reports that according to his observation, the Exposition management is further behind in its preparations than were most of the other big fairs at the corresponding time.

OBITUARY.

MR. WILLIAM D. LANDON, foreman of construction for the Western Union Telegraph Company in the Boston district, and for 34 years in the service of the company, died at Somerville, Mass., February 15. He was a native of Vermont and was 54 years old.

MR. THOMAS JEFFERSON EMERY, an early experimenter in telephony, died in Somerville, Mass., February 17. He was born in Charlestown 73 years ago. As a youth he, with a brother, connected two dwellings with a line with batteries attached, modeling their apparatus on the telegraph, then in use.

MR. WILLIAM HENRY BOARDMAN, for many years president of the *Railroad Gazette,* now the *Railway Age Gazette,* and for eight years its editor, died at Ridgefield, Conn., aged 67, on February 17. Mr. Boardman became connected with the *Railroad Gazette* shortly after his graduation from the University of Michigan, in 1869. As a pioneer of lawn tennis in America he designed the once famous "Franklin" racquet. He was former president of the Adirondack League Club and a member of the Century, Camp Fire and St. Andrew's Golf clubs of New York.

NEW PUBLICATIONS.

RAILWAY ASSOCIATION PROCEEDINGS.—The Proceedings of the American Electric Railway Engineering Association for 1913 has come from the press. It contains a complete report of the eleventh annual convention held at Atlantic City, N. J., last October. The frontispiece is a portrait of President Martin Schreiber.

WATT-HOUR METERS.—Technical Paper No. 207 of the Bureau of Standards is entitled "A Comparative Study of American Direct-Current Watt-Hour Meters," by T. T. Fitch and C. J. Huber. This considers the performance under test, the details of construction, the effect of friction losses upon the load curve, and a bibliography of the subject. Six makes of American meters are included in the tests.

DATES AHEAD.

State Independent Telephone Association. Des Moines, Iowa, March 10-12. Secretary, Charles C. Deering, 309 Life Building, Des Moines, Iowa.

Telegraphers' Mutual Benefit Association. New York, N. Y., March 11. Secretary, M. J. O'Leary, 195 Broadway, New York, N. Y.

Buffalo Electric Show. Elmwood Music Hall, Buffalo, N. Y., March 9-14. Secretary, Harry S. Hilliker, Electric Building, Buffalo, N. Y.

American Railway Engineering Association. Annual convention, Chicago, Ill., March 17-20. Secretary, E. H. Pritch, 900 South Michigan Avenue, Chicago, Ill.

Minnesota Electrical Association. Annual convention, Minneapolis, Minn., March 18-20. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Society of Efficiency, New York, N. Y. April 4-11. Secretary, W. H. Tallis, 41 Park Row, New York City.

American Electrochemical Society. Twenty-fifth general meeting, New York, N. Y., April 16-18. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

Iowa Electrical Association. Cedar Rapids, Iowa, April 23-24. Secretary, H. B. Maynard, Waterloo, Iowa.

Iowa Street and Interurban Railway Association. Cedar Rapids, Iowa, April 23-25. Secretary, H. E. Weeks, Davenport, Iowa.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore Coliseum, Cleveland, O.

Association of Railway Telegraph Superintendents. Annual meeting, New Orleans, La., May 19-22. Secretary, P. W. Drew, 112 West Adams Street, Chicago.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

Missouri Electric, Gas, Street Railway and Waterworks Association. Annual convention, on board steamer *Quincy* en route from St. Louis to Keokuk, Iowa, and return, May 21-23. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

National District Heating Association. Sixth annual convention, Rochester, N. Y., May 26-28. Secretary, D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, O.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

Delta-Star Electric Company, Chicago, Ill., is distributing an illustrated flyer showing several types of modern outdoor high-tension substations; copies of this will be sent on request to the company.

A. Hall Berry, New York, N. Y., announces ready for distribution a new bulletin on Hartford time switches for electrical supply jobbers. This gives technical information, sizes, capacities, type, list and discount price.

North Electric Company, Cleveland, O., has been placed in the hands of receivers upon the application of an employee, Joseph S. Blake. Common Pleas Court Judge Collister has appointed Dean C. Talbott and John T. Scott receivers.

Central Electric Company, 320 South Fifth Avenue, Chicago, in the February issue of *Electron*, publishes some interesting information on the lighting of bank buildings. B. J. Kacin contributes an article entitled "Commerically Educating the Young Men." Another interesting article is entitled "What One Cent's Worth of Electricity Will Do."

Pawling & Harnischfeger Company, Milwaukee, Wis., has issued a 30-page well-illustrated book entitled "Difficult Drilling and Boring Made Easy." It describes the Pawling & Harnischfeger horizontal drilling and boring machines and gives views in many machine shops in various parts of the country in which these machines have been very successfully used in facilitating work of this kind.

Duncan Electric Manufacturing Company, Lafayette, Ind., has issued bulletin No. 27. This is devoted to Duncan direct-current watt-hour meters for lighting and power service. These instruments are made in a variety of types, each of which is illustrated and described at some length. The parts of the meters are also similarly treated. A number of valuable hints on the care of meters are included in the bulletin.

The F. W. Wakefield Brass Company, Vermilion, O., has issued catalog No. 14 of Wakefield electric lighting fixtures. This catalog contains 78 pages, on each of which are several designs of various fixtures, including bracket, chandelier, short-stem ceiling fixtures, showers and a great variety of other fixtures. Brief data are given for each design. Several of the more distinctive lines of fixtures are described somewhat at length.

Siemens & Halske Aktiengesellschaft, Berlin, Germany, has issued a 24-page reprint of the lecture delivered by Dr. A. Franke on "High-Speed Telegraphs," which was presented before the Elektrotechnischer Verein. This publication, which is designated as bulletin No. 171, is very completely illustrated and describes the completely developed Siemens & Halske system of high-speed printing telegraphy which has been so successfully adopted in Europe.

National Carbon Company, Cleveland, O., has filed an increase in its capital stock at Trenton, N. J., from $10,000,000 to $17,600,000. The net income of the company for the past fiscal year was $1,476,641. The following directors have been elected: J. S. Crider, E. Hackenberg, J. L. Severance, M. T. Herrick and Andrew Squire, of Cleveland; John S. Bartlett, Boston; John P. Wilson, Chicago; Conrad Hubert and F. C. Walcott, New York; Barker Gummere, Jr., Trenton, N. J.; and James Parmelee, Washington, D. C.

The Emerson Electric Manufacturing Company, 2024 Washington Avenue, St. Louis, Mo., announces in the February number of its house organ, *The Emerson Monthly*, that it is prepared to send samples of Emerson fan motors of the new oscillating type on 30 days' trial to any responsible dealer in this country. The five-year guarantee on Emerson fans is also emphasized. Extracts from the new ordinance on the ventilation of moving-picture theaters recently adopted in New York City are given; these requirements should create an active demand for exhaust fans and for bracket, ceiling or similar fans for keeping the air of the theater in motion.

Century Electric Company, St. Louis, Mo., has ready for distribution bulletin No. 22, describing and illustrating its alternating-current fans for 1914. Century fan motors are what are generally known as the split-phase induction type of single-phase motor. Both the disk and oscillating types of fans are constructed for all frequencies between 25 and 140 cycles and for any voltage between 100 and 250 volts. All fans (excepting 133-cycle) are provided with a five-point switch and speed coil located in the base of the fan. Another new bulletin, No. 21, describes and illustrates Century single-phase self-starting motors of the repulsion-induction type. These bulletins will be furnished to those interested upon request.

The Richardson-Phenix Company, Milwaukee, Wis., has issued bulletin No. 57, which is devoted to the Phenix sight flow indicators. This publication illustrates and describes how this device can be inserted in any pipe line carrying a liquid and how it shows at a glance or indicates electrically by lighting a lamp or ringing a bell when the flow of liquid is interrupted. Among the uses for such an instrument are installation in the water line of a water-cooled transformer and in the supply line to the water jacket of a gas engine or air compressor. The bulletin also points out a number of recent improvements in the instrument, by means of which it gives an alarm before the liquid stops flowing entirely or when the flow drops to some predetermined minimum. Copies of this bulletin may be obtained by addressing the company.

The Standard Paint Company, New York, N. Y., is celebrating the thirtieth anniversay of its organization. The manufacture of its P. & B. insulating paint and compound has been carried on since 1884, and regardless of the developments in the severity of service requirements it is stated that the component parts of the material are almost idential with what they were when this material was first offered to the industry. The P. & B. insulating paint and compound has certainly stood the test of time. In the January issue of *Exchange*, the bulletin published by the company for its selling organization and agents, the company states: "The applause that greeted P. & B. paint and compound in 1884 has reverberated through all of the 30 years intervening between then and now. Success was great and that success has not been dimmed by time. P. & B. stood absolutely alone in 1884 and it stands not only without a peer, but without an equal in 1914.

Record of Electrical Patents.

Issued by the United States Patent Office, February 17, 1914.

1,087,109. Scraper for Electric Rails. A. Demmler, Forest Park, Ill. A link-supported frame carries a number of oscillatable scrapers.

1,087,113. Machine for Receiving Electric Waves. R. Goldschmidt, Berlin, Germany. Includes two interconnected commutators driven asynchronously to receive high-frequency electromagnetic waves.

1,087,115. Recording Attachment for Pianos. N. Goodrich, Detroit, Mich. A pedal-controlled electromagnetically operated printing arrangment.

1,087,120. Indicating Means for Inclosed Fuses. C. Hooker, assignor to Johns-Pratt Co., Hartford, Conn. Two

fine wires connected to the fuse have their ends on opposite sides of an external paper film that is punctured by the circuit voltage when the fuse has blown.

1,087,126. Arrangement for Producing Slightly Damped Electrical Oscillations. B. Macku, Brünn, Austria-Hungary, and L. Mandelstam and N. Papalexi, Strassburg, Germany. A quenched-spark system with three oscillation circuits.

1,087,127 and 1,087,128. Telephonic Receiver. A. Marr, Manchester, England. The first patent relates to the diaphragm mounting; the second patent to a special cup for the pole pieces of the magnet.

1,087,131. Electric Contact Device. H. McQuown, assignor to A. A. Kent, Philadelphia, Pa. Includes a rotating arm and cam.

1,087,143. Primary Battery. A. L. Saltzman, assignor to New Jersey Patent Co., West Orange, N. J. A frame for supporting the elements from the cover of the jar.

1,087,166. Dynamo-Electric Machine. A M. Gray, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. The rotor of an induction motor having special ventilating blades.

1,087,170. Controller. A. J. Loguin, assignor to Allis-Chalmers Mfg. Co. Push-button control for the handle of a drum-type controller.

1,087,180. Apparatus for Amplifying or Detecting Electrical Variations. G. W. Pierce, Cambridge, Mass. Includes a vacuum tube, two main and two auxiliary electrodes therefor, a battery and induction coils.

1,087,189. Measuring Instrument. E. O. Schweitzer, Chicago, Ill. A frequency meter comprising a galvanometer and a number of tuned reeds of graduated natural vibration rates.

1,087,198. Electric Heating Unit. C. S. Steward, Chattanooga, Tenn. For a rotatable disk plate, the current entering through trunnions.

1,087,189. Electric Stove. C. S. Steward. Has several disk units on top and compartments beneath them.

1,087,200. Electric Oven. C. S. Steward. Has heat-insulated and vented walls, a heating unit on top and one on the bottom.

1,087,221. Trolley-Wheel Support. L. W. DeYoung, Lebec, Cal. A special harp construction.

1,087,231. Automatic Controlling Device for Heating Apparatus. E. E. Gold, assignor to Gold Car Heating & Lighting Co., New York, N. Y. Electrical thermostatic control.

1,087,236. Storage-Battery Electrode and Process of Making Same. H. C. Hubbell, Newark, N. J. Consists of alternate layers of cadmium oxide and of a metal electronegative to cadmium in an alkaline electrolyte.

1,087,237. Process of Making Storage-Battery Electrodes. H. C. Hubbell. Consists in uniting into a plate alternate layers of nickel, cobalt and copper, dissolving out the copper layers and oxidizing the cobalt layers.

1,087,238. Electric Switch. G. L. Hughes, Chicago, Ill., assignor of one-half to R. E. Cooper. Electromagnetically operated.

1,087,251. Electric Switch. J. A. Meaher, Cleveland, O. Includes a double truncated conical guide, a switch lever and a spring-pressed plunger pin longitudinally movable in the switch lever and in contact with the cone-shaped parts.

1,087,276. Car Fender. D. Chew, Philadelphia, Pa., assignor of one-half to E. G. Idell. Electromagnets are adapted to hold the scoop in lowered position.

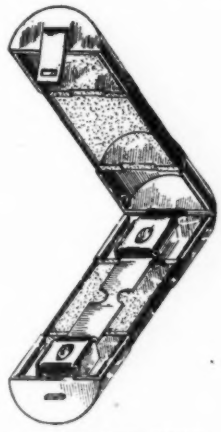
1,087,277. Toy. D. P. Clark, Dayton, O. A reversing toy electric locomotive.

1,087,278. Wardrobe. C. J. Coleman, New York, N. Y. Includes an electric heater automatically controlled to keep the temperature between certain limits.

1,087,288. Gearing. E. A. Halbleib, Rochester, N. Y., assignor to North East Electric Co. For connecting a motor-generator to an automobile engine.

1,087,289. Storage-Battery System. E. A. Halbleib, assignor to Northeast Electric Co., Rochester, N. Y. A gas-tight casing with diaphragm for the battery is connected to a circuit-breaker to cut off the charge when a certain gas pressure has been developed.

1,087,300. Coin-Controlled Switch for Electric Circuits. T. McA. Knox, U. S. Army, and F. W. Brockhoff, Jefferson Barracks, Mo. Includes a cam disk with which a part of the switch engages and gearing for rotating the disk into a set position.



1,087,417—Fuse-Holder.

1,087,301. Bracket Arm. F. P. Kobert, New Haven, Conn. For a cable rack; has a deep longitudinal groove to the bottom inner end of which a heel piece is welded.

1,087,302. Electric-Cable-Supporting Bracket. F. P. Kobert. The heel pieces of the arms fit into sockets in a vertical channel bar.

1,087,322. Apparatus for Actuating Conduit-Covers and Collector-Plows of Electric Railways. D. D. Samaia, Milan, Italy. Compressed-air cylinder for opening the conduit and raising or lowering the contact shoe.

1,087,328. Wheel Mount. F. Siwak, Clifton Heights, Pa., assignor of one-third to S. Siwak and one-third to P. Hnatszn. For a trolley pole.

1,087,329. Apparatus to Indicate the Stoppage of Carriers in the Transmission-Tubes of Pneumatic-Dispatch-Tube Systems. J. F. Skirrow, East Orange, N. J. An electric alarm adjacent the receiving terminal of the tube.

1,087,355. System of Control. L. Dreyfus, assignor to General Electric Co. Includes a polyphase machine with a commutator and brushes and an induction regulator mechanically connected to the brush yoke, the regulator having a secondary winding connected to portions of the stator winding and to the brushes.

1,087,357. Cutout and Fuse Mechanism. E. B. Ellicott, assignor to General Electric Co. Carries a terminal frame and switch blade on top of the insulator and a fuse holder in a tubular passageway.

1,087,377. Arc Lamp. C. C. Hughes, Philadelphia, Pa., assignor to Hughes Universal Arc Lamp Co., Philadelphia, Pa The clutch mechanism is controlled by the contraction and expansion of a long wire.

1,087,381. Brush for Dynamo-Electrical Machines. E. C. Ketchum, Boston, and D. H. Andrews, Newton, Mass. Composed of a number of separate plates having thin conducting material between corresponding ends thereof.

1,087,383. Device for Preventing Formation of Burs in Electric Welding. W. A. Kilmer and A. T. Weaver, assignors to American Steel & Wire Co. of New Jersey, Hoboken, N. J. Includes two sets of welding clamps, a pair of brushes between them and adapted to surround the wire at the point of weld and means for rotating the brushes around the wire.

1,087,384. Method of and Apparatus for Preventing Formation of Burs on Electric Welds. W. A. Kilmer and A. T. Weaver, assignors to American Steel & Wire Co. of New Jersey. A modification of the above.

1,087,396. Trolley Wheel. A. Perry San Francisco, Cal. Has a special oil chamber.

1,087,417. Fuse-Holder. H. W. Young, Chicago, Ill. The tubular casing is longitudinally split into two parts hinged together at one end and carrying semicircular bridges near the ends of the replaceable fuse link. (See cut.)

1,087,445. Calculating Apparatus. A. B. Herrick, Ridgewood, N. J. A planigraph chart with scales and slides for working electrical problems.

1,087,453. Electric Distributing Device. R. H. Manross, Forestville, Conn. Comprises stationary and movable contacts, the latter mounted on a disk.

1,087,454. Control Device for Automobile Self-Starters. A. L. McMurtry, Sound Beach, Conn. Movement of a piston actuates both the battery switch and spark control.

1,087,461. Current-Controlling Mechanism. L. T. Rhoades, Mont Clare, Pa. Engine-driven cam-controlled contact device.

1,087,485. Safety Device for Automobiles. E. Favary, New York, N. Y. Comprises chauffeur-controlled means for operating a commutator, means for applying the brake, and means controlled by the passengers and auxiliary to the first-named means for advancing the ignition and applying the brake.

1,087,494. System of Electric-Motor Control. H. D. James, assignor to Westinghouse Electric & Mfg. Co. A relay switch co-operates with the drum controller to govern the accelerating switches.

1,087,500. Circuit-Breaker. H. G. MacDonald, assignor to Westinghouse

Electric & Mfg. Co. Has special toggle mechanism.

1,087,507. Movable-Target System. M. A. Palen, U. S. Army. Includes electric operating means.

1,087,518. Electric Heater. J. G. Wallman, Oakland, Cal. For a long boiler.

1,087,531. Battery-Tray Connection. J. N. Davis, Denver, Colo. A special drain in the bottom of the tray.

1,087,532. Optical Instrument. H. L. De Zeng, Maple Shade, N. J. Opthalmoscope with a reflector, lenses, electric lamp and battery, and light filters.

1,087,537. Circuit-Changer for Electric Railways. B. F. Hutches, Jr., Allendale, N. J. A trolley-circuit-changer with several electromagnets and an oscillated contact arm.

1,087,548. Combination Tail-Light, Sign-Plate, and Holder Therefor for Vehicles. E. E. Poole, Boston, Mass. Includes an electric lamp.

1,087,549. Receiver for Wireless-Transmission Signals. V. Poulsen, Copenhagen, Denmark. Provides means for intermittently connecting wave detector to the antenna.

1,087,556. Electric Motor. H. K. Sandell, assigner to Mills Novelty Co., Chicago, Ill. An oscillatory motor.

1,087,574. Illuminated Sign. J. L. Dawes, Pittsburgh, Pa. Comprises two metallic rings hinged together at one side, a convex lens in each of the rings and a lamp extending into the sign at the side opposite the hinges. (See cut.)

1,087,592. Electric Heater. F. Kuhn, Detroit, Mich. An armored heating unit is within an air heat-insulated chamber.

1,087,593. Electrically Heated Foot-Warmer. F. Kuhn. The heating element is inclosed within a case which has a fabric covering.

1,087,594 and 1,087,595. Electric Heater. F. Kuhn. Has a disk-shaped heating unit in contact with the bottom.

1,087,596. Circuit-Opening Switch for Electric Heaters. R. Kuhn, Detroit, Mich. A special connector plug and socket.

1,087,607. Electric Steam-Heater. C C. Ponting, Medford, Oreg. A self-contained steam radiator with an electric heating coil in the bottom circulating pipe.

1,087,612. Dry-Cell Battery. C. W. Simmons, East Cleveland, O. Consists of a zinc plate inclosed within an absorbant envelop and having indentations in both sides to form reservoirs for the electrolyte, cathodes on both sides of the plate and a depolarizing mixture between the cathodes and zinc plate.

1,087,623. Insulated Rail-Joint. H. L. Wood, assignor to Rail Joint Co., New York, N. Y. Has both fiber and wood-block insulation.

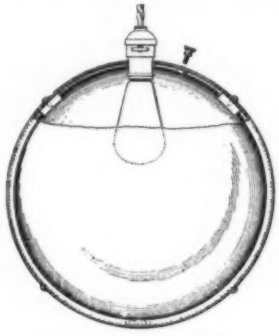
1,087,630 and 1,087,631. Timing Mechanism. B. C. Batcheller, New York, N. Y. Electrical time control for the electric motor that drives the air compressor for a pneumatic-tube dispatch system.

1,087,637. Separator for Storage-Battery Plates. C. C. Carpenter, assignor to United States Light & Heating Co., New York, N. Y. A thin sheet of wood having an outer layer of rubber vulcanized thereon.

1,087,651. Spark Collector and Distributor. M. Gerardy, Wathena, Kans. A distributor and timer for an electric ignition system.

1,087,673. Steady-Strain Device for Trolley Constructions. O. S. Lyford, Jr., New York, N. Y. For a catenary trolley line.

1,087,699. Attachment for Moving-Picture Apparatus. A. Szeliga, New York, N. Y., assignor to one-fifth to P. Müller, one-fifth to E. Mauthberger, and one-tenth to F. Tichy. Ignition to the film opens the circuit of the driving motor and of the projecting lamp and causes de-energization of an electromagnet to release a film-severing knife.

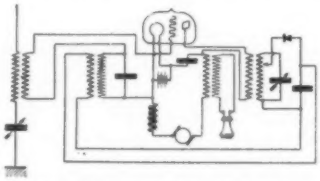


1,087,574—Electric Sign.

1,087,701. Interrupter for Electrical Ignition Apparatus for Internal-Combustion Engines Having a Device for Adjusting the Time of Sparking. G. Unterberg, Durlach, Germany. An arrangement of cams and levers.

1,087,704. Head-Support for Telephone Receivers. C. Adams-Randall, Boston, Mass. An adjustable head band for holding a receiver to each ear.

1,087,716. Printing Machine. G. M. Breckenridge, Chicago, Ill., assignor of one-third to J. P. McManus. Special switch control and clutch for a motor-driven press



1,087,892—Wireless Receiver.

1,087,807. Telephone Support. K. B. Miller and C. G. Ashley, assignors to McMeen & Miller, Chicago, Ill. A supporting arm for a desk set is adjustable around a horizontal and a vertical pivot.

1,087,808. Telephone Support. K. B. Miller, assignor to McMeen & Miller. A modification of the above.

1,087,834. Machine for Cutting Fabric Along the Edge of Embroidery. E. Schelling, Zurich, Switzerland. Has electrical means to reverse the direction of travel of the carriage.

1,087,853. Renewable Cartridge-Fuse. N. D. Urquhart, Glenwood Springs, Colo. .The knife-blade terminals are of a strip bent upon itself with V-shaped internal extensions fitting into the caps of the case.

1,087,876. Machine for Making Bead Chains. G. W. Goodridge and W. J. Gagnon, assignors to Bryant Electric Co., Bridgeport, Conn. Comprises means for drawing a ribbon into a tube and for shaping it into a series of connected dumb-bells, also means for forming a tool into hollow balls over the dumb-bells

1,087,880. Electrical Controller. D. J. Hauss. Aurora, Ind. A double-ended resistance-adjusting arm is arranged to also connect the machine to the resistance as a motor or generator.

1,087,887. Electric Water-Heater and Steam-Generator. A. P. Nichols, Seattle, Wash. A boiler with tubular electrodes.

1,087,889. Exhibiting Apparatus. A. P. Roesener, New York, N. Y. Includes an electric lamp and solenoid slide control.

1,087,892. Means for Receiving Electrical Oscillations. W. Schloemilch and O. von Bronk, Berlin, Germany. Includes a vacuum tube containing a permanently ionized gas and a supplementary detector. (See cut.)

1,087.897. Spark Plug. C. E. Talbert, assignor to E. C. Henn, Cleveland, O. Has a number of sparking surfaces.

1.087.902. Bill-Printing Mechanism. C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Combined with two normally disconnected printing wheels is a solenoid for operating one wheel, a switch and a connecting device brought into position to connect the two wheels by operation of the switch.

Patents Expired.

The following United States electrical patents expired February 23, 1914:

577,427. Alternating-Current Motor. L.Gutmann, Pittsburgh, Pa.

577,447. Automatic Circuit-Breaker. G. F. Packard, Fort Wayne, Ind.

577,450. Electric-Railway System. C. F. De Redon, New York, N. Y.

577,480. Electric Transformer. L. Gutmann.

577,493. Electric Furnace. F. J. Patten, New York, N. Y.

577,499 Filament for Electric Lamps. J. H. Douglas-Willan and F. E. W. Bowen, London, England.

577,501 Electrically Operated Ship's Log. W. S. Alexander, New York, N. Y.

577,526. Electropneumatic Brake. F. Chapsal, Paris, France.

577,534. Submarine Telegraphy. A. Muirhead, London, England.

577,540. Telegraph Transmitter. H. A. Taylor, London, England.

577,550. Electric and Gravity Pleasure-Railway. J. A. Griffiths, Philadelphia, Pa.

577,635. Electric Signal for Highway Crossings. W. W. Alexander and M. C. Gillham, Kansas City, Mo.

577,636. Apparatus for Producing Ozone. E. Andreoli, London, England.

577,644. Electrical Elevator. J. P. Casey, Philadelphia, Pa.

577,704. Electrical Insulator. T. W. Young, Washington, D. C.

577,741. Trolley for Electric Railways H. N. Gale, Bristol, Conn.

577,760. Electric Arc Lamp. G. M. Lane, Asbury Park, N. J.

577,771. Secondary Battery H. G. Morris, Philadelphia, Pa.

577,816. Device for Controlling Light Effects. H. V. Arnold, New York, N. Y.

577,822. Electric Cutout. J. F. McElroy, Albany, N. Y.